



THE GRADUATE SCHOOL



**ANNOUNCEMENTS
1967-68**

West Virginia University Bulletin

YEAR 1967

JANUARY							FEBRUARY							MARCH							APRIL							
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
1	2	3	4	5	6	7	5	6	7	8	9	10	11	5	6	7	8	9	10	11	2	3	4	5	6	7	1	
8	9	10	11	12	13	14	12	13	14	15	16	17	18	12	13	14	15	16	17	18	9	10	11	12	13	14	15	
15	16	17	18	19	20	21	19	20	21	22	23	24	25	19	20	21	22	23	24	25	16	17	18	19	20	21	22	
22	23	24	25	26	27	28	26	27	28	29	30	31		26	27	28	29	30	31		23	24	25	26	27	28	29	
29	30	31					26	27	28					30	31						30							
MAY							JUNE							JULY							AUGUST							
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
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8	9	10	11	12	13	14	4	5	6	7	8	9	10	11	9	10	11	12	13	14	15	6	7	8	9	10	11	12
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SEPTEMBER							OCTOBER							NOVEMBER							DECEMBER							
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	
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17	18	19	20	21	22	23	22	23	24	25	26	27	28	17	18	19	20	21	22	23	17	18	19	20	21	22	23	
24	25	26	27	28	29	30	29	30	31					26	27	28	29	30		31	24	25	26	27	28	29	30	

YEAR 1968

JANUARY							FEBRUARY							MARCH							APRIL							
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	
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14	15	16	17	18	19	20	11	12	13	14	15	16	17	10	11	12	13	14	15	16	14	15	16	17	18	19	20	
21	22	23	24	25	26	27	18	19	20	21	22	23	24	18	19	20	21	22	23	24	21	22	23	24	25	26	27	
28	29	30	31				25	26	27	28	29			24	25	26	27	28	29	30	31	28	29	30				
MAY							JUNE							JULY							AUGUST							
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	
5	6	7	8	9	10	11	2	3	4	5	6	7	8	7	8	9	10	11	12	13	4	5	6	7	8	9	10	
12	13	14	15	16	17	18	11	12	13	14	15	16	17	10	11	12	13	14	15	16	11	12	13	14	15	16	17	
19	20	21	22	23	24	25	16	17	18	19	20	21	22	16	17	18	19	20	21	22	18	19	20	21	22	23	24	
26	27	28	29	30	31		23	24	25	26	27	28	29	30	23	24	25	26	27	28	29	25	26	27	28	29	30	31
SEPTEMBER							OCTOBER							NOVEMBER							DECEMBER							
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	
8	9	10	11	12	13	14	6	7	8	9	10	11	12	13	3	4	5	6	7	8	9	8	9	10	11	12	13	14
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22	23	24	25	26	27	28	21	22	23	24	25	26	27	28	17	18	19	20	21	22	23	22	23	24	25	26	27	28
29	30						27	28	29	30	31			24	25	26	27	28	29	30	29	30	31					

ON THE COVER—Memorial Plaza on the Downtown Campus, featuring the mast of the U.S.S. *West Virginia*

ANNOUNCEMENTS OF

THE GRADUATE SCHOOL

1967-68 SESSION



WEST VIRGINIA UNIVERSITY BULLETIN

West Virginia University

MORGANTOWN

ESTABLISHED FEBRUARY 7, 1867

The Board of Governors

	TERM EXPIRES
ALBERT B. C. BRAY, JR., <i>President</i> , Logan	1972
RALPH J. BEAN, <i>Vice-President</i> , Moorefield	1970
K. DOUGLAS BOWERS, <i>Secretary</i> , Beckley	1971
MRS. GILBERT S. BACHMANN, Wheeling	1973
OKEY B. GLENN, Williamson (Deceased)	1968
THOMAS L. HARRIS, Parkersburg	1974
FORREST H. KIRKPATRICK, Wheeling	1975
JAMES H. SWADLEY, JR., Keyser	1967
CHARLES C. WISE, JR., Charleston	1969
HARRY B. HEFLIN, <i>Chief Executive Officer</i> , Morgantown	

The Board of Governors has charge of the educational, administrative, financial, and business affairs of the University and Potomac State College of West Virginia University.

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Issued Monday, Wednesday, and Friday
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UNIVERSITY CALENDAR

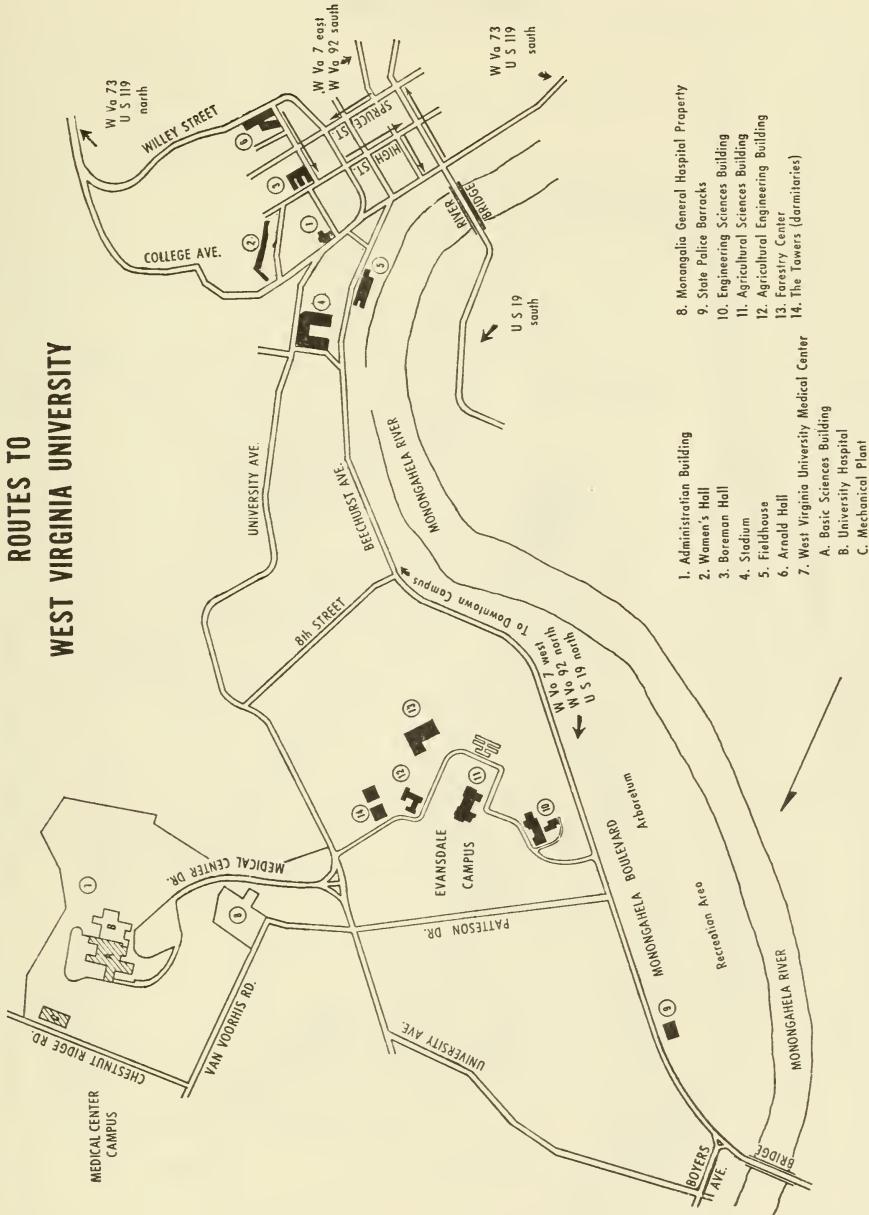
1967

May 13, Saturday	Alumni Day
May 14, Sunday	Commencement Exercises
June 12, Monday	Registration for Summer Session
June 13, Tuesday	First Classes, Summer Session
July 4, Tuesday	Independence Day Recess
July 12, Wednesday	English Proficiency Examination
August 12, Saturday	Close of Summer Session
August 27, Sunday, to August 29, Tuesday, incl.	Freshman Orientation
August 28, Monday	General Registration, First Semester
August 29, Tuesday	General and Freshman Registration
August 30, Wednesday	First Classes, First Semester
September 4, Monday	Labor Day Recess
October 5, Thursday	English Proficiency Examination
October 10, Tuesday	Meeting of Faculty Assembly
October 23, Monday	Mid-Semester Reports Due
November 23, Thursday, to November 26, Sunday, incl.	Thanksgiving Recess
December 13, Wednesday	Last Classes, First Semester
December 15, Friday, to December 20, Wednesday	Final Examinations, First Semester
December 21, Thursday, to January 4, Thursday, incl.	Christmas Recess

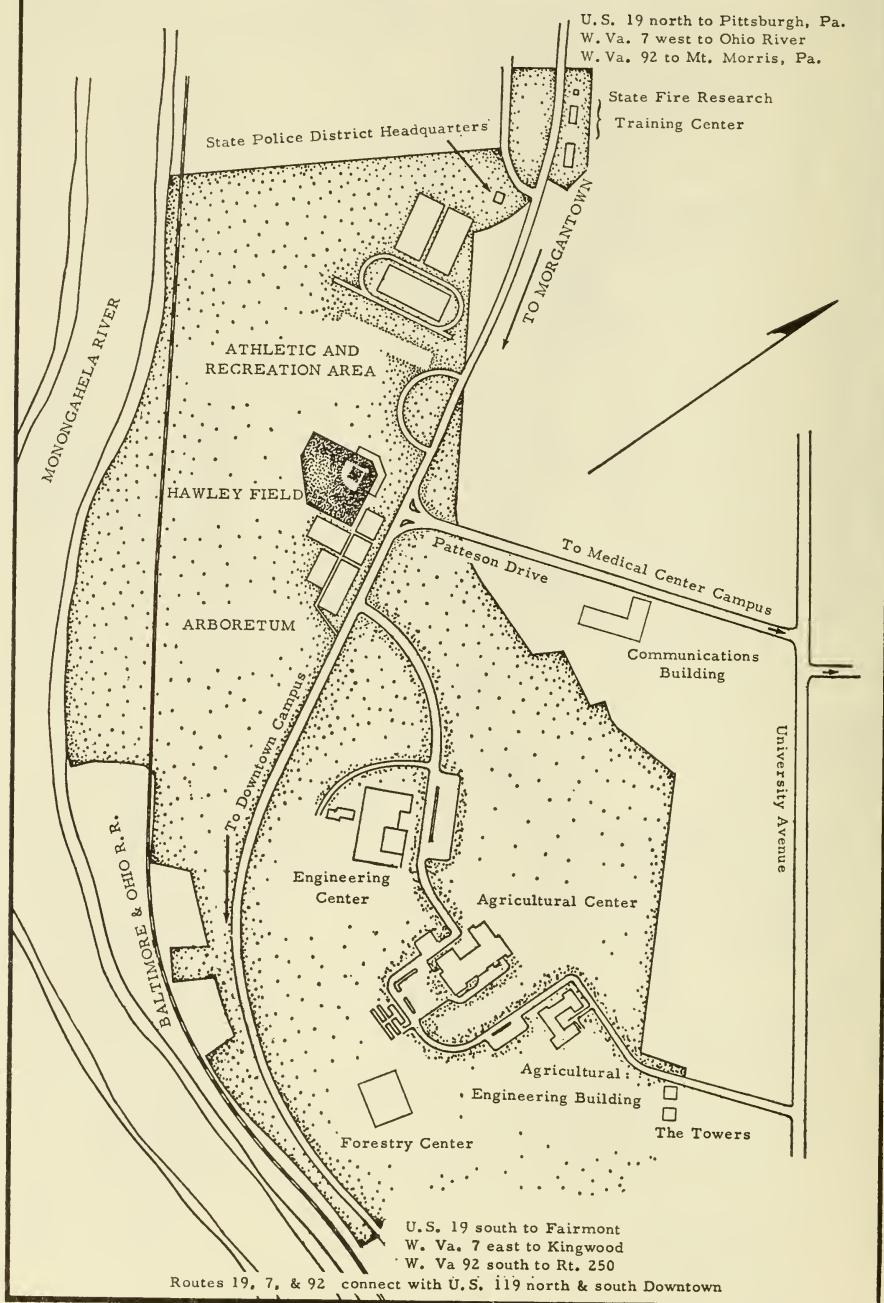
1968

January 5 and 6, Friday and Saturday	General Registration, Second Semester
January 8, Monday	First Classes, Second Semester
February 7, Wednesday	West Virginia University Day
February 8, Thursday	English Proficiency Examination
February 26, Monday	Mid-Semester Reports Due
March 3, Sunday, to March 10, Sunday, incl.	Recess
April 9, Tuesday	Meeting of Faculty Assembly
April 29, Monday	Last Classes, Second Semester
May 1, Wednesday, to May 6, Monday, incl.	Final Examinations, Second Semester
May 8, Wednesday	Grade Reports for Graduating Seniors and Graduate Students Due in Deans' Offices
May 9, Thursday	Deans' Reports of Graduates Due in Registrar's Office
May 11, Saturday	Alumni Day
May 12, Sunday	Commencement Exercises

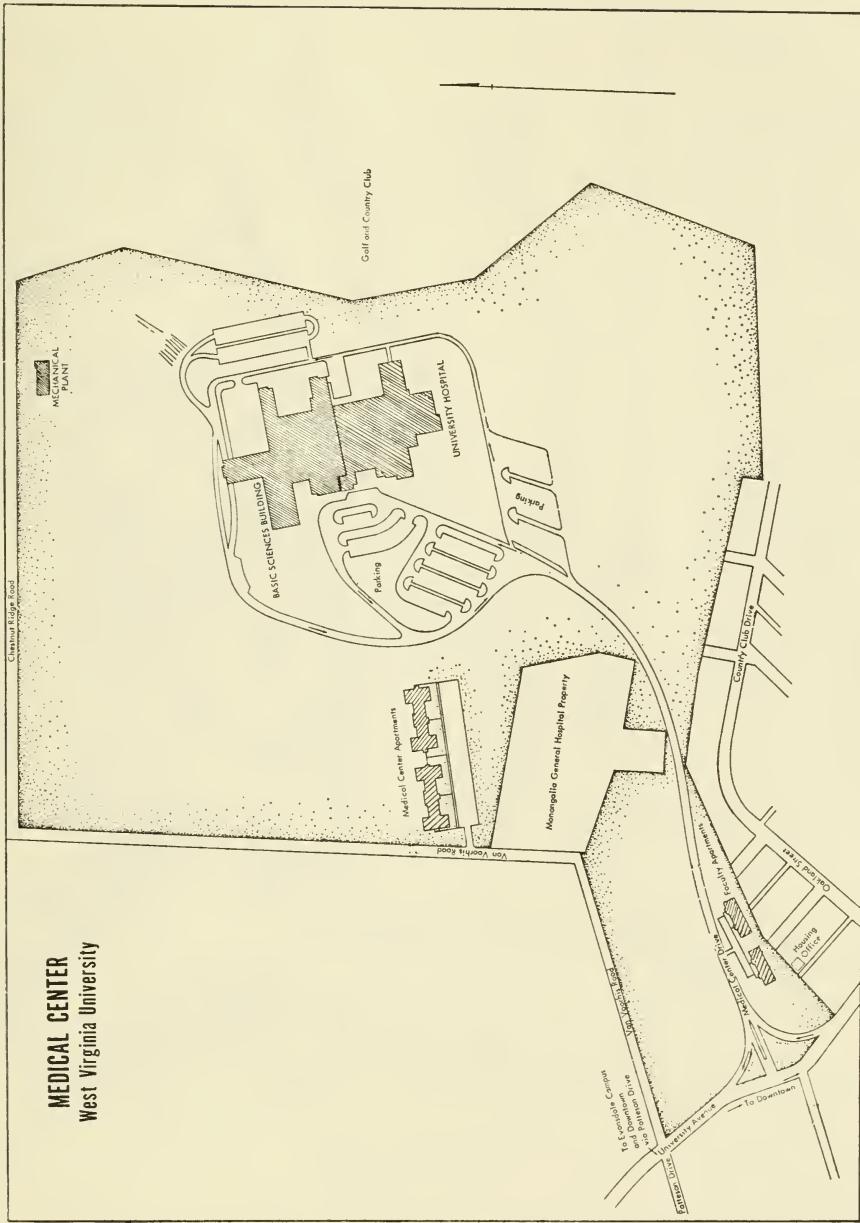
ROUTES TO
WEST VIRGINIA UNIVERSITY



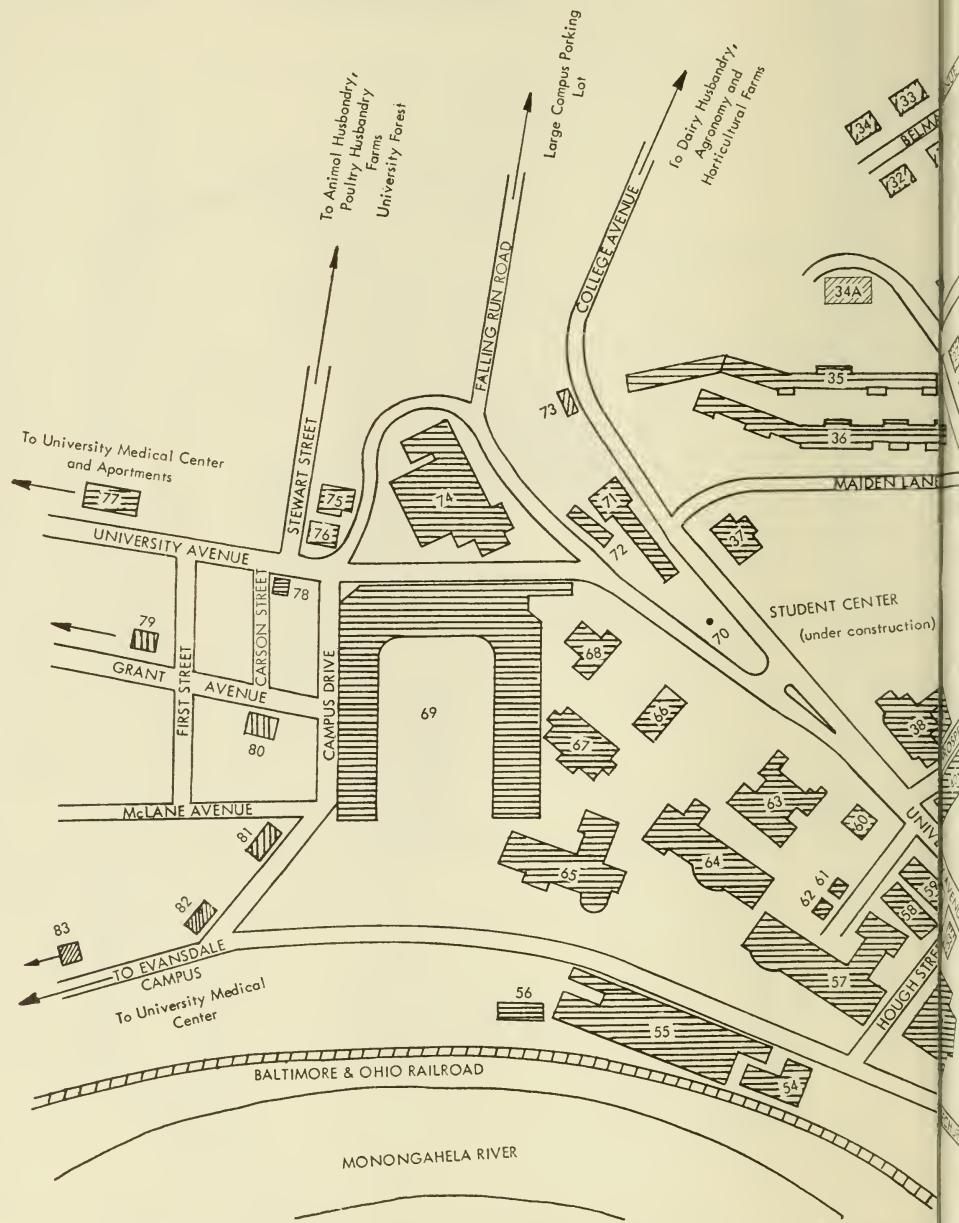
EVANSDALE CAMPUS



MEDICAL CENTER
West Virginia University



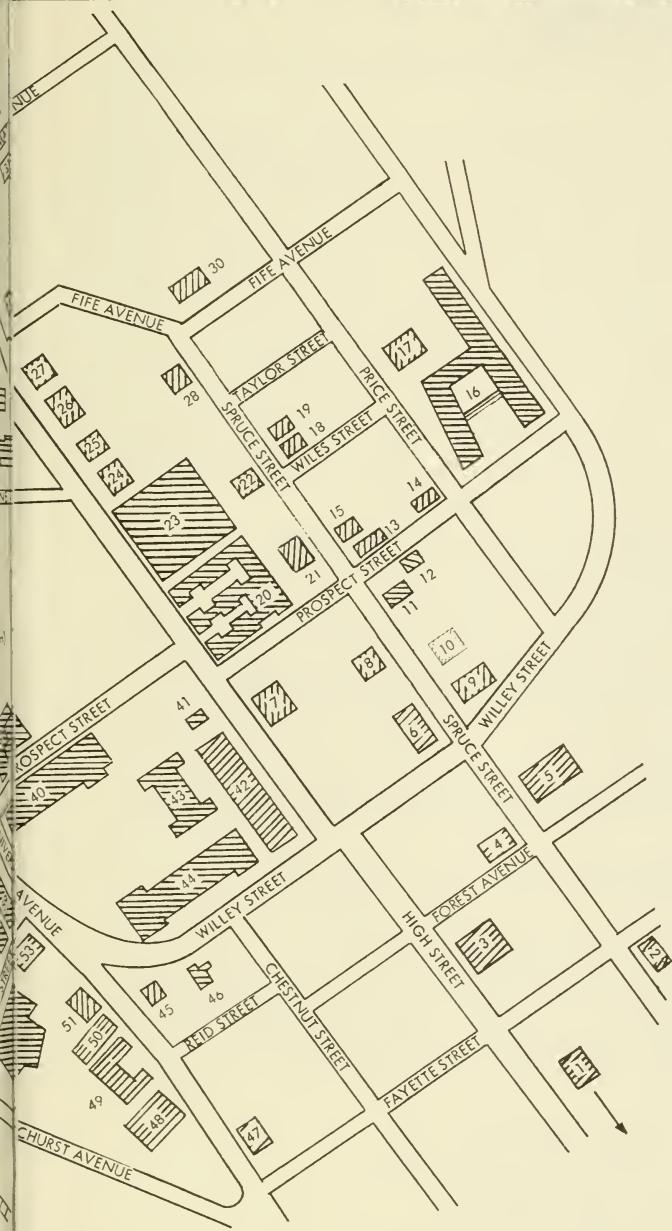
WEST VIRGINIA UNIVERSITY



1. Christian Church-Disciples Fellowship
2. Spruce Street Methodist Church
3. Baptist Church Student Fellowship
4. Greek Orthodox Church-Greek Orthodox Youth of America

5. Presbyterian Church-Westminster Foundation
6. Episcopal Church-Canterbury Association
7. Chi Omega Sorority
8. Phi Kappa Sigma Fraternity

DOWNTOWN CAMPUS



Alpha Phi Sorority
 Kappa Delta Sorority
 80 Spruce Street
 184 Prospect Street
 Kappa Kappa Gamma Sorority

14. Alpha Delta Pi Sorority
 15. Alpha Xi Delta Sorority
 16. Arnold Hall and Arnold Apartments
 17. Delta Gamma Sorority
 18. Delta Delta Delta Sorority

19. Alpha Phi Delta Fraternity
20. Boren Hall—South
21. Gamma Phi Beta Sorority
22. Theta Chi Fraternity
23. Boren Hall—North
24. Delta Tau Delta Fraternity
25. Kappa Alpha Fraternity
26. Phi Sigma Kappa Fraternity
27. Tau Kappa Epsilon Fraternity
28. Phi Sigma Delta Fraternity
29. Sigma Chi Fraternity
30. Phi Kappa Psi Fraternity
31. Sigma Nu Fraternity
32. Kappa Sigma Fraternity
33. Beta Theta Pi Fraternity
34. Phi Delta Theta Fraternity
- 34A. Sigma Phi Epsilon Fraternity
35. Terrace Hall
36. Women's Hall
37. Health Center
38. Administration Building
39. Computer Center
40. Chemistry Building
41. Social Work Office
42. Methodist Church—Wesley Foundation
43. Library
44. Mineral Industries Building
45. Personnel Office
46. 128 Willey Street
47. Jewish Youth Center—Hillel Foundation
48. St. Theresa's Catholic Church
49. Newman Club (Catholic youth group)
50. St. John's Chapel
51. Pi Beta Phi Sorority
52. Music Building
53. Music Annex and Lutheran Student Association
54. Industrial Arts
55. Field House
56. Heating Plant
57. Physics Building
58. Bookstore
59. Law Building
60. 1549 University Avenue
61. Counseling Center
62. Placement Office
63. Elizabeth Moore Hall
64. Armstrong Hall
65. Brooks Hall
66. Martin Hall
67. Woodburn Hall
68. Science Hall
69. Mountaineer Field
70. Memorial Plaza (U.S.S. W.Va.)
71. Oglebay Hall
72. Oglebay Hall Annex
73. 721 College Avenue
74. Mountainair
75. Plant Pathology Greenhouse
76. "Old" Forestry Building
77. Evangelical United Brethren Church—Student Youth Fellowship
78. Industrial Arts Annex
79. Alpha Gamma Rho Fraternity
80. Lambda Chi Alpha Fraternity
81. Pi Kappa Alpha Fraternity
82. Nursery School
83. St. Paul Lutheran Church (Patteson Drive)

ADMINISTRATIVE OFFICERS

GENERAL

President, HARRY BRUCE HEFLIN, A.B., A.M., PH.D., LL.D., (*Acting*), (1966), 1964.
Provost, ROBERT FERGUSON MUNN, A.B., M.A., PH.D., (*Acting*), (1965), 1952.
Vice-President—Administration and Finance, HARRY BRUCE HEFLIN, A.B., A.M., PH.D., LL.D., (1964).
Vice President—Appalachian Center, ERNEST JOSEPH NESIUS, B.S.A., M.S.A., PH.D., (1963), 1960.
Vice-President—Medical Center, EDWARD GEORGE STUART, B.S., M.A., PH.D., M.D., (1966), 1960.
Director of Student Educational Services, DAVID NORMAN HESS, A.B., B.D., M.A., PH.D., (1965), 1963.
Assistant to the President for Special Affairs, EMERY FRANK BACON, B.A., M.A., (1965).
Director of Admissions and Assistant to the President, EARL RUFFNER BOGGS, A.B., M.A., PH.D., (1965), 1960.
Director of University Relations, HAROLD JOSEPH SHAMBERGER, A.B., M.P.A., (*Acting*), (1963), 1949.
Associate Director of Student Educational Services, JOSEPH CLAY GLUCK, B.A., B.D., (1965), 1943.
Registrar, STANLEY ROBERT HARRIS, A.B., M.S., (1963), 1953.
Comptroller, WILLIAM HAYWARD McMILLION, B.S., M.S., (1965), 1952.
Director of Libraries, ROBERT FERGUSON MUNN, A.B., M.A., PH.D., (1957), 1952.
Director of Alumni Affairs, DAVID WOOD JACOBS, A.B., (1938).
Director of Development, DONOVAN HINER BOND, B.S.J., M.A., (1959), 1946.
Professor of Air Force Aerospace Studies, COL. CHAZ M. HOLLAND, B.B.A., M.B.A., M.A. INT.A., (1966).
Professor of Military Science, COL. EDWIN WENDELL REYNOLDS, B.S., (1962).
Director of University Hospital, EUGENE LEO STAPLES, B.S., M.H.A., (1960).
Director of Intercollegiate Athletics, ROBERT NATHAN BROWN, A.B., (1954), 1950.

COLLEGES AND SCHOOLS

Agriculture and Forestry, ROBERT STANDISH DUNBAR, JR., PH.D., *Dean*, (1964), 1952.
Agricultural Experiment Station, A. H. VANLANDINGHAM, PH.D., *Director*, (1959), 1929.
Arts and Sciences, CARL MAYNARD FRASURE, PH.D., *Dean*, (1961), 1927.
Commerce, THOMAS CORWITH CAMPBELL, JR., PH.D., *Dean*, (1964), 1948.
Creative Arts Center, RICHARD EDWARD DUNCAN, PH.D., *Dean and Director*, (1964), 1958.
Dentistry, KENNETH VINCENT RANDOLPH, D.D.S., *Dean*, (1958), 1957.
Engineering, CHESTER ABBO ARENTS, M.E., *Dean*, (1955).
Engineering Experiment Station, JAMES ALBERT KENT, PH.D., *Associate Director*, (1963), 1958.
Graduate, ROBERT FERGUSON MUNN, A.B., M.A., PH.D., *Acting Dean*, (1965), 1952.
JOHN CHARLES LUDLUM, PH.D., *Assistant Dean*, (1965), 1946.
Human Resources and Education, STANLEY OLIVER IKENBERRY, PH.D., *Dean*, (1965), 1962.
Journalism, QUINTUS CHARLES WILSON, PH.D., *Dean*, (1961).
Law, PAUL LAMBERT SELBY, JR., LL.B., *Dean*, (1964).
Medicine, CLARK KENDALL SLEETH, M.D., *Dean*, (1961), 1935.
Mines, CHARLES THOMAS HOLLAND, M.S.E.M., *Dean*, (1961), 1930.
Nursing, DOROTHY MAE MAJOR, ED.D., *Dean*, (1960).
Pharmacy, RAPHAEL OTTO BACHMANN, PH.D., *Dean*, (1961).
Physical Education, RAY OSCAR DUNCAN, ED.D., *Dean*, (1952).

NOTE: The date in parentheses indicates year of latest appointment. The second date indicates year of first appointment to a University position.

HEADS OF OTHER ADMINISTRATIVE OFFICES

Biological Sciences, Institute of, EDWARD GEORGE STUART, PH.D., M.D., *Director*, (1964).
Book Store, RUTH ELEANOR ROBINSON, A.M., *Manager*, (1944), 1939.
Computer Center, ERNEST LEWIS JONES, M.A., *Director*, (1966).
Housing, ROBERT ALLEN ROBARDS, B.S.B.A., *Director*, (1965), 1960.
Nursing Service, AUDREY EDITH WINDEMUTH, M.S., *Director*, (1961), 1960.
Personnel, S. THOMAS SERPENTO, M.A., *Director*, (1964), 1960.
Physical Plant, VERGIL B. CLARK, M.S., *Director*, (1965).
Regional Research Institute, WILLIAM HENRY MIERNYK, PH.D., *Director*, (1965).
Residence Halls, AGNES BERDELIA HOVEE, M.A., *Director*, (1956), 1950.
Student Educational Services
 Director, DAVID NORMAN HESS, PH.D., (1965), 1963.
 Associate Director, JOSEPH CLAY GLUCK, A.B., B.D., (1965), 1943.
 Counseling Service, JAMES FRANKLIN CARRUTH, PH.D., *Director*, (1965), 1953.
 Foreign Student Coordinator, JULIAN WELDON MARTIN, B.S.C.H.E., (1965), 1964.
 Health Service, JOHN JOSEPH LAWLESS, PH.D., M.D., *Director*, (1965), 1935.
 Mountainlair, ROBERT FRANCIS MCWHORTER, M.S., *Director*, (1965), 1959.
 Placement Service, MARGARET CORNELIA LADWIG, PH.D., *Adviser*, (1965), 1949.
 Residence Hall Programs and Dean of Women, BETTY BOYD, A.B., (1965), 1948.
Student Financial Aids, GORDON RUDOLPH THORN, M.A., (1965), 1957.
Student Programs, JAMES VERNE WATKINS, M.S., (1965), 1959.
University High School, DELMAS FERGUSON MILLER, PH.D., *Director*, (1960), 1949.
 E. GRANT NINE, M.S., *Principal* (1960), 1956.
University Relations, HAROLD JOSEPH SHAMBERGER, M.P.A., *Acting Director*, (1963), 1949.
 Publications, JOHN LUCHOK, B.S.J., *Editor*, (1953), 1950.
 News and Information Services, JOHN LUCHOK, B.S.J., *Acting Director* (1967), 1950.
 Radio, Television, and Motion Pictures, C. GREGORY VAN CAMP, M.S.J., *Director*, (1960).
West Virginia Center for Appalachian Studies and Development
 Cooperative Extension Service, ERNEST JOSEPH NESIUS, PH.D., *Director*, (1963), 1960.
 Continuing Education and Extended Credit Programs, KEITH ELDEN GLANCY, PH.D., *State Chairman*, (1965), 1959.
 Extension Services, ROMAN JOSEPH VERHAALEN, PH.D., *Dean*, (1964).
 Institute for Labor Studies, FREDERICK ANTHONY ZELLER, PH.D., *Director*, (1965).
 International Programs, RALPH E. NELSON, PH.D., *Director*, (1965), 1954.
 Kanawha Valley Graduate Center, BRUCE M. JOHN, M.S., *Director*, (1966), 1963.
 Parkersburg Center, BILLY LEE COFFINDAFFER, PH.D., *Dean*, (1966), 1950.
 Research and Development, Office of, ROBERT G. DYCK, M.C.P., *Acting Director*, (1965), 1963.

GRADUATE SCHOOL EXECUTIVE COMMITTEE

ROBERT FERGUSON MUNN, PH.D., *Chairman*.
JOHN CHARLES LUDLUM, PH.D., (ex officio), *Assistant Dean*.
HUGH ALEXANDER LINDSAY, PH.D., *Associate Professor of Physiology*.
DELMAS FERGUSON MILLER, PH.D., *Professor of Education*.
HOMER C. EVANS, PH.D., *Professor of Agricultural Economics*.
JAMES HAMILTON SCHAUB, PH.D., *Professor of Civil Engineering*.

Standing Committees

THE UNIVERSITY

ADMISSIONS: Director of Admissions, the Registrar, and the Deans of all Colleges and schools admitting freshmen.

BOARD OF GOVERNORS SCHOLARSHIPS:

Undergraduate: F. J. HOLTER, C. W. BROWN, J. C. GLUCK, S. R. HARRIS, ROGERS MCAVOY, L. W. WELDEN, and Q. C. WILSON.

Graduate: F. J. HOLTER, S. E. DADISMAN, G. O'C. HARVEY, K. V. RANDOLPH, and J. C. STICKNEY.

SPACE ALLOCATION: A. R. COLLETT, C. A. ARENTS, R. S. DUNBAR, JR., R. O. DUNCAN, V. B. CLARK, S. R. HARRIS, W. H. McMILLION, and C. R. WAGNER.

DISCIPLINE: M. L. VEST, MARY C. BUSWELL, and R. F. KRAUSE.

THE SENATE

CONSTITUTIONAL COMMITTEES

EXECUTIVE: ACTING PRESIDENT HEFLIN, *Chairman*; E. B. FLINK, M. E. GALLEGLY, D. F. MILLER, J. H. SCHAUER, G. H. STEWART, J. R. WILLIAMS, and W. H. BAKER, *Secretary*.

MEMBERSHIP AND CONSTITUENCIES: F. E. LORINCE, JR., *Chairman*; W. R. BIDDINGTON, R. W. LAIRD, W. R. SUMMERS, JR., C. P. YOST, and W. H. BAKER (*ex officio*).

STANDING COMMITTEES

TEACHER EVALUATION: W. M. BAGBY, *Chairman*; J. D. ADAMS, G. C. ANDERSON, E. C. BARBE, SARA ANN BROWN, WINCIE ANN CARRUTH, ALAN DONALDSON, R. E. FOSTER, EMILE FRERE, A. F. GALLI, VIRGINIA P. HAGEMANN, F. J. HOLTER, A. N. HOFSTETTER, R. L. JACK, MARY ROSE JONES, MORTIMER LEVINE, D. R. LEYDEN, W. D. LORENSEN, D. W. MACDOWELL, J. L. MCBEE, BETTY L. MILLER, D. F. MILLER, L. L. OURTH, E. R. PAGE, M. E. POOL, E. W. REYNOLDS, BERNHARD SCHER, D. C. SHELTON, R. D. SLONNEGER, N. S. SMITH, JR., PAULINE F. STEELE, W. V. WAGNER, and W. H. BAKER.

NEW COURSES AND COURSE CHANGES: H. A. GIBBARD, *Chairman*; R. C. BAILIE, O. J. BURGER, R. G. BURRELL, A. S. PAVLOVIC, and J. C. LUDLUM (*ex officio*).

FACULTY WELFARE: A. F. WOJCIK, *Chairman*; L. H. BROWN, J. A. JACOBSON, M. E. POOL, and F. E. WRIGHT, II.

STUDENT INSTRUCTION: R. D. SLONNEGER, *Chairman*; H. E. KIDDER, P. L. SELBY, JR., ROBERT STILWELL, K. A. COOK, and President of Student Body (*ex officio*).

RESEARCH, RESEARCH GRANTS, AND PUBLICATIONS: A. D. KENNY, *Chairman*; J. H. CHAPMAN, JR., D. G. TEMPLE, VALENTIN ULRICH, D. T. WORRELL, and JOHN LUCHOK (*ex officio*).

SPECIAL COMMITTEES

CALENDAR: SAM BOYD, JR., *Chairman*; S. R. HARRIS, PETER POPOVICH, BARBARA JONES, and T. J. BRENNAN.

GRADUATE FACULTY-SENATE RELATIONSHIP: J. H. SCHAUER, *Chairman*; W. T. DOHERTY, JR., H. C. EVANS, D. J. HORVATH, H. A. LINDSAY, D. F. MILLER, and V. J. TRAYNELIS.

Part I

GENERAL INFORMATION

West Virginia University, founded February 7, 1867, has entered its centennial year at a time of growth of its student body, faculties and staff, expansion of physical plant, and redirection and reform of its objectives and programs unprecedented in its history.

West Virginia University combines in a single institution the functions of a state and of a state land-grant university—functions commonly assigned to two or more institutions in other state settings. Hence, the range and variety of instructional, research, and service programs at West Virginia University is greater than that of most institutions its size. The *primary* mission of the University within the West Virginia system of higher education is to serve as the major center of professional and graduate training and research in the State. The rapid movement of the University in this direction is reflected in the fact that, from 1954-55 to 1965-66, University undergraduate enrollment rose by one-half while graduate and professional school enrollments more than doubled. In the same period, total University operating expenditures more than tripled from \$10.7 million to \$38.8 million.

HISTORY

The University had its origin in the Morrill Act of July 2, 1862, and in an act of the 1863 State legislature accepting the provisions of that act.

On January 9, 1866, trustees of the Monongalia Academy in Morgantown offered the State all of its property, including the site of Woodburn Female Seminary on condition that the new institution be located there.

The offer was accepted and on February 7, 1867, the Agricultural College of West Virginia was established. The following year, President Alexander Martin succeeded in persuading the legislature to change the name of the institution to West Virginia University.

During the institution's early years, its supporters were divided on whether it should be a "state-supported university" or a "first-class state-supported college." The university concept won out in 1895, when President James L. Goodknight organized a College of Engineering and Mechanic Arts, a College of Arts and Sciences, a College of Law, and a College of Agriculture.

The major academic divisions of the University today are: the College of Agriculture and Forestry; the College of Arts and Sciences; the College of Commerce; the Creative Arts Center; the School of Dentistry; the College of Engineering; the Graduate School; the College of Human Resources and Education; the School of Journalism; the College of Law; the School of Medicine; the Division of Military Science and the Division of Air Force Aerospace Studies; the School of Mines; the School of Nursing; the School of Pharmacy; and the School of Physical Education.

INSTRUCTIONAL SCHEDULE

The University year is divided into two semesters of approximately seventeen weeks each and a summer session of nine weeks. The University Calendar is on page 4.

ACCREDITATION

West Virginia University is a member of the North Central Association of Colleges and Secondary Schools. All of the University's educational programs are fully accredited by the North Central Association and by the appropriate accreditation agencies of the professional schools.

ENROLLMENT

The University's total enrollment on September 30, 1966, was 12,083. Of this number, 2,779 students were enrolled in graduate or post-baccalaureate professional programs, 418 students were attending the Parkersburg Center, and 73 were enrolled at the University's Kanawha Valley Graduate Center.

LOCATIONAL CHARACTERISTICS

Morgantown is a city of 25,000 population, although together with suburban communities, its metropolitan area population is estimated at 40,000. The major growth of Morgantown took place in the 1920's, based on the coal-mining industry. In the 1960's coal mining remains a major industry in the environs of the town, but, with mechanization of its operations, it now accounts for only 10 per cent of the labor force. Meanwhile, education and ancillary services have taken the coal industry's place as the principal source of local employment. West Virginia University itself is by far the largest single employer, accounting for some 20 per cent of Monongalia County employment.

Located on the east bank of the Monongahela River, which flows north to Pittsburgh, Morgantown is situated on rugged terrain of the Appalachian Highlands resulting from erosion of the Appalachian Plateau. The latitude is 39.4 degrees north. The altitude of the city varies from 800 to 1,150 feet above sea level, while the hills of the environs rise eastward to Chestnut Ridge which has altitudes of 2,600 feet just 10 miles from the city. Average temperature the year round is 50.6 degrees, with a summer average of 69.8 and a winter average of 25.3. Average annual rainfall is 40.61 inches. Morgantown's climate may therefore be described as temperate, with some features of a mountain environment.

Morgantown is served by bus and by air but not by passenger trains. Lake Central Airlines provides direct air service from and to Charleston, the state capital, and Wheeling, Pittsburgh, Washington, D.C., Columbus, Cincinnati, and Indianapolis.

A limousine service to Grafton, 25 miles from Morgantown, connects with the few Baltimore & Ohio Railroad passenger trains.

U.S. Routes 19 and 119 pass through Morgantown in the north-south direction. Pittsburgh is 72 miles due north, while the cities of Charleston, W. Va., Washington, Baltimore, Cleveland, and Columbus, Ohio, all lie from 200 to 220 miles distant. A north-south interstate highway, I-79, is being constructed to pass just west of Morgantown.

There are two State facilities in the immediate vicinity of Morgantown. Mont Chateau State Park and Lodge is in a fine setting overlooking Cheat Lake. It affords restaurant and overnight lodging and conference facilities. Visitors to the park have such recreational options as swimming, boating, water skiing and fishing in Cheat Lake, hiking and horseback riding on mountain trails, and winter sports. Cooper's Rock State Forest affords a camping facility, a beautiful picnic and hiking area, a trout fishing pond which is regularly stocked, and spectacular views over the Cheat River Valley. These preserves are reached by West Virginia Route 73 (north). Cheat Lake is about five miles from the center of Morgantown, and the Cooper's Rock parking area is about seven miles farther.

PHYSICAL PLANT

The campuses of West Virginia University cover some 600 acres, including 75 acres of the Downtown Campus near the center of Morgantown; 275 acres at Evansdale, a half-mile north of the Downtown Campus; and 260 acres in the Medical Center area. The University also has more than 11,000 acres of experimental farms and forests and educational camps located in many parts of the State.

Some of the main buildings, together with dates of their original construction or acquisition, follow:

Martin Hall, 1870; Woodburn Hall, 1876; Science Hall, 1893; Administration Building, 1902; Oglebay Hall, 1918; Women's Hall, 1919; Law Building, 1923; Mountaineer Field, 1925; Chemistry Building, 1925; Elizabeth Moore Hall, 1928; Field House, 1929; Library, 1931; University High, 1933; Boreman Hall, 1935; Mineral Industries Building, 1942; Terrace Hall, 1942; Health Center, 1942; "Old" Forestry Building, 1946; "Old" Mountainlair, 1948; Armstrong Hall, 1950; Brooks Hall, 1951; Physics Building, 1952; Music Building, 1954; Arnold Hall, 1957; Basic Sciences Building—Medical Center, 1957; Book Store Building, 1958; Boreman Hall, North, 1959; University Hospital, 1959; Engineering Sciences Building, 1961; Agricultural Sciences Building, 1961; Agricultural Engineering Building, 1961; Medical Center Apartments, 1961; an addition to Arnold Hall, 1961; three apartment buildings for married students at College Park, 1962, and four in 1963; Forestry Building, 1965; and two Evansdale Tower dormitories, 1965.

In addition the University owns and operates experimental dairy, horticulture, animal husbandry, agronomy, and poultry farms in Monongalia County; and other farms at Kearneysville, Jefferson County; Wardensville, Hardy County; Reedsville, Preston County; and Point Pleasant, Mason County. Also the Tygart Valley Experimental Forest, Randolph County; and West Virginia University Forest, at Cooper's Rock, near Morgantown.

Area Appalachian Center headquarters, in addition to one in Morgantown, are in Beckley, Charleston (Institute), Jackson's Mill, Keyser, and Parkersburg, and there are county offices throughout the State. Camp Arthur Wood, a forestry and geology camp, was obtained in 1948 at Alvon, near White Sulphur Springs, Greenbrier County, and the Terra Alta Biological Station in 1950. A 100-acre Arboretum, containing almost every plant and flower native to West Virginia, is open to visitors at the Evansdale Campus.

ACADEMIC UNITS ON THE DOWNTOWN CAMPUS

The work of the College of Arts and Sciences, which enrolls the majority of lower-division students, is centered on the Downtown Campus. Modern facilities for the biological and physical sciences are provided in Brooks Hall (Biology), the Mineral Industries Building (Geology and School of Mines), the Physics Building, and the Chemistry Building, with its new \$2.3 million research annex now under construction. The University Library and the new \$6.5 million Mountainlair student center (with greatly expanded parking facilities) are the other two key buildings of this campus. The University residence halls for some 1,600 undergraduates, the sororities and fraternities, and some of the dormitories recently constructed by private interests are located on and around this campus.

The College of Commerce, the College of Human Resources and Education, and the School of Journalism are also located on the Downtown Campus. The second half of the sixties will see a relocation of other facilities from the Downtown to the Evansdale Campus: the Divisions of Art, Drama, and Music will be housed in a new \$7 million Creative Arts Center; and the School of Physical Education will acquire a major new facility in a new field house. The relocation of the College of Law and the School of Mines, now on the Downtown Campus, also is contemplated.

Apart from these buildings, the Downtown Campus buildings are general purpose classroom and office buildings which have seen a variety of uses in their lifetime: the three oldest, grouped around Woodburn Circle, which form the "old grads'" symbol of the University; Armstrong Hall, the first of the postwar building expansion; Oglebay Hall (originally for agriculture), Law Building, Mineral Industries Building, "Old" Forestry Building, and Music Building.

An ornament of the Downtown Campus is Elizabeth Moore Hall, women's social and physical education building, which provides a gracious setting for many campus receptions and other social gatherings. It is flanked on University Avenue by the former house of the president, converted in the mid-sixties to offices, and these are faced, across the street, by the Administration Building (once the University Library) and the new Mountainlair (now under construction).

ACADEMIC UNITS ON THE EVANSDALE CAMPUS

The University's Evansdale Campus is the site of the Engineering Sciences, Agricultural Sciences, Agricultural Engineering, and Forestry buildings. The former three buildings were put into service in 1961 and are helping the College of Agriculture and Forestry and the College of Engineering to improve their teaching and research programs to keep pace with modern technology and provide services demanded by today's industry and agriculture.

The Forestry Building was opened for use in September, 1965. It is designed to accommodate an enrollment of 400 undergraduate and 50 graduate students. The three-story building provides 100,000 square feet of space—about four times as much as the "old" Forestry Building on the Downtown Campus. Additional floors can be added as needed. The wood sciences facilities occupy a large area of the building. Other important laboratories include wood seasoning and preservation, wood identification, and wood chemistry. The new building provides the State, for the first time, with adequate laboratory facilities for research in many areas of forestry that have long been neglected. The University's high-level irradiation facility is in the new Forestry Building.

The Engineering Sciences Building consists of an 11-story tower on a 3-story base. A nearby structure houses subsonic and supersonic wind tunnels and a propulsion laboratory for Aerospace Engineering.

The three-story Agricultural Sciences Building houses all agricultural departments except Plant Pathology, Bacteriology, and Entomology (Brooks Hall), and Agricultural Engineering. The Department of Agricultural Engineering has its own building at Evansdale, near the Forestry Building and the Agricultural Sciences Building. Also located nearby is a modern horticultural greenhouse.

The new Tower dormitories, housing 900 students, were first occupied in September, 1965. Another set of Towers is under construction.

The Office of Publications, formerly housed in the basement of Woodburn Hall, was moved in January, 1965, to new quarters on Patteson Drive (Communications Building). The Physical Plant Warehouse is at Birch Street and University Avenue. The Creative Arts Center is now under construction near the intersection of Monongahela Boulevard and Patteson Drive.

Most of the University's future physical growth will take place in the Evansdale and Medical Center campus areas.

MEDICAL CENTER

The University's Medical Center is a unique institution in West Virginia offering teaching, research, and service programs in the health professions and sciences. More than 2,000 persons are involved in the teaching, research, and service functions of the Medical Center—including faculty, staff, and student body.

The Medical Center is composed of four schools, Dentistry, Medicine, Nursing, and Pharmacy, as well as the University Hospital. The latter is a Statewide referral center for diagnostic and treatment services for patients with difficult medical problems.

In addition to the educational programs offered by the four professional schools, the divisions of Medical Technology and Dental Hygiene also offer degree programs. The departments of Anatomy, Biochemistry, Microbiology, Physiology, and Pharmacology, comprising the Basic Sciences, offer masters and doctoral programs in these disciplines as well as in certain approved interdisciplinary areas in conjunction with the Institute of Biological Sciences. Internship and residency training is offered by the schools of Medicine and Dentistry in conjunction with the University Hospital.

Health Sciences research programs at the Medical Center are diverse and involve every school, department, and division, as well as the University Hospital and related University units. Support currently amounts to \$2.5 million, most of which comes from the National Institutes of Health of the U. S. Public Health Service. Private West Virginia organizations, such as the State Heart Association, State Cancer Society, and the State TB and Health Association, support research projects. Among the most active areas in investigation are the heart and major blood vessel disease, cancer (including leukemia), problems of metabolism, and problems of oxygen supplied to the central nervous system. Recently the U. S. Public Health Service established the Appalachian Laboratory for Occupational Respiratory Diseases as a closely allied unit for investigation in pulmonary disorders relating to miner's diseases.

The service programs are concentrated in the University Hospital in-patient facilities, the out-patient clinic and emergency rooms, and in the School of Dentistry clinic. All patients are referred to the University Hospital by their family or community physicians. The Hospital capacity is 520 beds of which 406 are now commissioned and available.

Post-graduate education at the Medical Center is conducted regularly and also extends into cities and towns of West Virginia as a growing part of educational enterprise. During the past year, several post-graduate educational programs and special seminars were held for practitioners in Dentistry, Medicine, Pharmacy, and Nursing.

The Medical Center campus consists of the large 950-foot long main building called the "Medical Center" which is actually two buildings joined—the Basic Sciences Building and the University Hospital. In addition there is a coal-burning heating plant, two apartment buildings for married faculty and two larger apartment buildings for graduate students, faculty, and staff. The Medical Center campus is adjacent to the Morgantown Golf and Country Club which is currently being acquired by the University and which will assure more space for the growth of the Evansdale-Medical Center campuses.

APPALACHIAN CENTER

The pioneers in the land-grant movement intended to establish institutions through which knowledge and learning could be made an effective part of the daily lives of the American people.

The University works toward this goal through its many extension activities, which are available to everyone in the State.

With the establishment of the West Virginia Center for Appalachian Studies and Development, the University has brought a new approach to education in West Virginia. In the Appalachian Center are mobilized into one coordinated, yet flexible, effort all special public service skills—extension, consulting, research, planning—directed to the development and improvement of the State and region. Its activities and resources are focused on developing peoples' attitudes, utilizing human and natural resources, assisting private and public organizations and institutions, and participating in international affairs.

The program units of the Appalachian Center include the Office of Research and Development; the Cooperative Extension Service; University Extension and Continuing Education; Institute for Labor Studies; Mining and Industrial Extension Service; International Programs; Parkersburg Center of West Virginia University, and the Kanawha Valley Graduate Center of West Virginia University. The directors of the latter three units and of extension instruction for academic credit also have reporting responsibilities to the Provost of the University.

The Office of Research and Development is responsible for the coordination of applied research and planning activities of the University related to the social, economic, and educational development and improvement of the State and region.

The Cooperative Extension Service is responsible for programs of informal education related to youth development, agricultural production and marketing, consumer education, family-oriented projects, community improvement, resource development and conservation, public affairs, and rural and urban county extension programs through the area Appalachian centers.

University Extension offers college-credit courses, many of them taught by resident faculty members, at many places in West Virginia. The Institute for Labor Studies is designed to promote, organize, and conduct labor education activities in cooperation with union organizations.

More than 2,000 persons enroll annually in training courses offered in communities throughout the State by the Mining and Industrial Extension Service. The School of Mines also sponsors short courses in coal mining, coal preparation, mine equipment and maintenance, and gas measurement. In cooperation with the State fire marshal, it sponsors a State Fire School.

The International Programs unit is responsible for the U.S. AID cooperative programs that now exist between West Virginia University and Tanzania, Kenya, and Uganda, for international education contracts and agreements, and for administering and developing the overseas commitments of West Virginia University.

The University now has staff members in Tanzania, Kenya, and Uganda, and has undertaken the planning, construction, staffing, and development of curriculum for the new Agricultural College of Tanzania, now under construction.

The Parkersburg Center is a fully integrated component of West Virginia University. It began operations in September, 1961, and offers basic University course work to qualified persons at relatively low cost. The center maintains close liaison with the Parkersburg College Fund, a non-profit corporation, which was established to coordinate voluntary financial support for the branch.

The Kanawha Valley Graduate Center of West Virginia University at Institute opened in 1958. It includes programs leading to the master of science degree in chemistry, chemical engineering, mechanical engineering, and business administration. For further information call, or write, or visit the office, Room 111, Library Building (Ground Floor), West Virginia State College, Institute, West Virginia. Address mail to the Kanawha Valley Graduate Center, Box 308, Institute, West Virginia. Telephone 768-8815.

GOVERNMENT AND ORGANIZATION OF THE UNIVERSITY

The Board of Governors is vested by law with authority for the control and management of the educational, administrative, financial, and business affairs of the University, whose chief executive officer is the president of the University. The board is

bipartisan and consists of nine members appointed by the governor of the State with staggered terms of nine years. At least one member is appointed from each Congressional District, and at least four members must be graduates of West Virginia University. Members are eligible for reappointment.

The board also has responsibility for Potomac State College, a two-year institution at Keyser. Other public institutions of higher education in West Virginia are governed by the State Board of Education.

The President is the chief executive of the University. In this capacity, he is, *inter alia*, the principal academic officer and head of the faculties of the University, a role which his position as presiding officer of the University Senate symbolizes. The chief officers of administration, responsible and reporting directly to the President are: the Provost, the President's deputy for academic affairs who is presently also the Dean of the Graduate School, the Vice-President—Medical Center, the Vice-President—Appalachian Center, the Vice-President—Administration and Finance, the Director of Student Educational Services (who, however, as Assistant to the Provost, reports to him on matters directly bearing on the educational program of the University), and the Director of Development.

The Administrative Council, consisting of some twenty officers concerned with overall administration, acts in an advisory capacity to the President and assists him in carrying out established University policies. Within the council is an Executive Committee composed of the vice-presidents and immediate staff of the office of the president.

The University Senate was established by the Board of Governors in November, 1945, as the vehicle for faculty participation in the government of the University. It is a legislative body with original jurisdiction over all matters of academic interest and educational policy that concern the entire University or affect more than one college, school, or division. The Senate's decisions are subject to review and approval by the President and the Board of Governors.

A new constitution for faculty participation in University government was passed by a faculty referendum, approved by the Board of Governors, and put into effect through organization procedures in 1966. The chief provisions of the new constitution provide a representative Senate with broader powers and meeting more frequently (every month) than the former Senate. It includes the President of the University as Chairman, Provost, Academic Deans, five administrative officers appointed by the President, and Senators elected by the members of the University Faculty Assembly to represent the 15 college constituencies and one other constituency. Each constituency is entitled to one Senator for each twenty constituents who are members of the University Faculty Assembly.

The University Faculty Assembly includes the President of the University as Presiding Officer, Provost, Academic Deans, Professors, Associate Professors, Assistant Professors, and Instructors holding appointments on a full-time basis in the University, and such other persons engaged in full-time professional activities responsive to the academic obligations of the University as have been approved for membership by the Senate on the recommendation of the Committee on Membership and Constituencies. The Faculty Assembly normally meets twice a year.

The Graduate School administration is described on page 30.

LIVING ACCOMMODATIONS

The University Housing Center, 440 Medical Center Road (phone 293-3621), is the source of information concerning both University campus housing and privately-owned, off-campus housing. The University maintains seven residence halls, two for men and five for women. It also operates several hundred furnished and unfurnished apartments for married students, graduate students, faculty, and staff. There are many living accommodations in converted residences, in apartments, and in private homes, of which a few also board students. There is an increasing number of new large modern privately-owned dormitories and apartment houses near the campuses. Most of these have numerous units at reasonable rentals, but the earliest possible inquiries and attention to reservations are advised.

UNIVERSITY FINANCIAL STRUCTURE

INCOME

As might be expected, West Virginia University, as a State institution, draws most of its income from public sources. The operations of the Medical Center are separately financed from those of the rest of the University out of proceeds of a legislatively dedicated tax on soft drinks.

In fiscal year 1965-66, the University had available for current operating expenditures funds totaling \$38.8 million. The sources of these funds and the contributions of each as percentages of the total were approximately:

	PER CENT
1. Governmental appropriations (exclusive of income from contract research and services)	
State appropriations, including proceeds from Medical Center-dedicated tax	48.0
Federal appropriations	6.3
2. Endowment income, gifts, and grants	1.6
3. Sales and services of educational departments	0.9
4. Contract research and services	13.9
5. Organized activities relating to educational departments (i.e., from enterprises conducted primarily for purposes of giving professional training to students, such as University Hospital, University High School, Daily Athenaeum)	10.2
6. Auxiliary enterprises income (e.g., dining halls, residence halls, book stores, intercollegiate athletics, etc.)	10.9
7. Student aid income (scholarships, fellowships, etc.)	0.5
8. Miscellaneous (rentals, fines, interest in current funds)	0.1
9. July 1965 balances in non-reverting funds available for current operating expenditures	7.6
	<hr/> 100.0

EXPENDITURE

Total expenditure on current operations for fiscal year 1965-66 amounted to approximately \$35.5 million, which, by percentages, was allocated to the following categories:

	PER CENT
1. Administration and general	7.9
2. University libraries	2.0
3. Plant operation and maintenance	7.5
4. Resident instruction (total operating budgets of colleges and schools)	30.7
5. Organized activities related to instruction (including University High School, University Hospital, etc.)	16.9
6. Organized research	13.9
7. Organized extension	7.8
8. Intercollegiate athletics	2.1
9. Non-educational expense (Health Service, Alumni Association, University matching contribution for T.I.A.A., etc.)	3.9
10. Auxiliary enterprises and activities	7.3
	<hr/> 100.0

HEALTH SERVICE

The University Health Service provides medical care to students of the University and supervises general campus health conditions. The staff includes five full-time and four part-time physicians, four nurses, two laboratory technicians, and clerical personnel. The University Pharmacy, housed in the Health Center, is managed by the School of Pharmacy.

The Health Service occupies the Health Center on the Downtown Campus, constructed in 1942, and recently relocated and renovated. This three-story building is centrally located, fronting on College Avenue at Maiden Lane. It is built of brick and concrete and is fireproof throughout. On the first floor are the treatment rooms,

offices, and pharmacy. The second floor is occupied by laboratory and X-ray departments, and offices for physicians. The third floor houses the Student Counseling Service.

The Health Service is in operation from 8:00 A.M. to 5:00 P.M., daily, except Saturday and Sunday. Saturday hours are 8:00 A.M. to noon. Physicians are in attendance from 9:00 A.M. to noon, and 2:00 P.M. to 5:00 P.M. On Monday to Friday evenings a nurse is on duty at the Health Center from 7 to 10 P.M., with a physician from 8 to 10. A physician is present Saturday from 7 to 9 P.M., and on Sunday from 3 to 5 P.M. A University physician can always be reached by calling the Health Service, 293-2311, or the University telephone operator, 293-0111. Each regularly enrolled University student pays a fee which provides for medical consultation and advice from University physicians. Moderate additional charges are made for room calls, minor operations, treatment of fractures, and drugs furnished by the Health Service or Pharmacy.

THE INFIRMARY

Students who need bed care for medical illness are hospitalized at Station 82, University Hospital, which serves as the University Infirmary. The Infirmary is open only to full-time students. It is the policy of the Health Service to have all students requiring such care in the Infirmary. Students hospitalized in the Infirmary are under the care of Health Service physicians, although other qualified physicians may be seen in consultation when necessary. Patients will be admitted and discharged on the order of Health Service physicians.

Upon admission to the Infirmary the student receives two days of hospitalization without charge. Special nurses, when necessary, are at the expense of the student.

A student may not receive more than thirty days of hospitalization for any one illness. Patients are to leave when discharged by the University physicians. When it becomes evident that a student's illness will be so prolonged as to prevent his completing work of the current semester, he may be discharged from the Infirmary when the attending physician or the Director of the Health Service considers that he may be moved without undue danger to his health. The services as indicated above are subject to the availability of space in the Infirmary. Twenty-two beds at present are ready for use.

STUDENT INSURANCE

A voluntary insurance plan is available to students to supplement the medical care offered by the Health Service. The plan provides for payment for hospitalization, surgeon, and consultant's fees, and other medical costs throughout the year, both in Morgantown and elsewhere. For cost of this insurance and details concerning coverage see the brochure available at the Health Service.

STUDENT COUNSELING SERVICE

The University provides diagnostic testing and counseling for students with educational, vocational, and personal adjustment problems. These services are provided by counseling and clinical psychologists.

The Student Counseling Service is a voluntary, confidential resource for students. It is intended to serve students who want and need objective professional help in examining their own conflicts of motivation, feelings, or identity. Those in need of such help are not just the marginal and immature students, as might be supposed, but frequently the exceptionally able and conscientious students.

The counseling service should be regarded as a self-help resource for students. To be consistent with its particular usefulness, the service must be freely available on a confidential individual basis to those who can use it appropriately. Although similar in orientation and professional ethics, counseling service is not a form of medical treatment. Nor does it exist primarily to aid the University administration by screening students diagnostically or advising in discipline cases. The purpose is to provide a service directly to students.

If a student seeks aid from the service privately and on his own initiative, no consultation by the staff with anyone else is permitted without a request from the student. However, the faculty are invited to consult with the counseling staff on any student problem, prior to referral or without having referral in mind. Students have

been helped by intelligent listening and counseling support from a sympathetic faculty member. Many of the faculty call upon the counseling service to discuss severe student educational or adjustment problems, whether tests might be helpful, and to request advice about alternative ways of approaching these problems.

The student may make his own appointment at the offices on the third floor of the Health Center, phone 293-4432.

VETERANS

The University recognizes that men and women from the Armed Forces who enter college require individual and personalized guidance in order to facilitate their entrance and to aid their adjustment to University life. The Veterans Coordinator is available for consultation and help in the solution of personal problems which may arise in the transition to civilian student life.

Information regarding educational opportunities made possible at the University through provisions of the Veterans Readjustment Benefits Act of 1966—G.I. Bill (Public Law 358), the Vocational Rehabilitation Program of the Veterans Administration (Public Law 16), and the War Orphan's Educational Assistance Act of 1956 (Public Law 634) may be obtained from the Veterans Coordinator by personal conference or by mail. An amendment to Public Law 634, passed by Congress in the summer of 1964, provides benefits to many dependents of 100 per cent disabled veterans.

FOREIGN STUDENTS

There are approximately 200 foreign students from more than thirty-six countries at West Virginia University. More than 100 are graduate students.

The Foreign Student Relations Committee of student government is active in sponsoring "International Week" during the Fall semester and in planning outings, nationality nights, and in organizing an orientation program for new foreign students. The Cosmopolitan Club is an organization of internationally-minded students which sponsors cultural and social programs and holds an annual "International Night" of music, dancing, drama, and international exhibits. For this reason foreign students are encouraged to bring examples of their national dress, musical instruments, information concerning their country, recipes of national dishes, etc.

A group of Morgantown women have organized the *International Neighbors* for the wives of foreign faculty and students and female foreign faculty members. The *Host Family Program* gives the foreign student an opportunity to meet and visit with an American family for leisure time activities.

All foreign student applications for admission should be submitted to the Director of Admissions with a score on "The Test of English as a Second Language" (TOEFL) at least four months in advance of the proposed date of entry.

Because of a shortage of adequate apartments with cooking facilities, foreign students are encouraged to make housing reservations in advance by sending a \$25.00 deposit, made payable to West Virginia University, to the foreign student adviser or by coming several weeks before the beginning of the semester.

Foreign Students seeking information and advice should write to the Foreign Student Adviser, West Virginia University, Morgantown, W. Va. 26506.

THE UNIVERSITY LIBRARY SYSTEM

The West Virginia University libraries contain approximately 700,000 volumes, 34,000 maps, 8,500 reels of microfilm, and over 50,000 technical reports. About 30,000 volumes are added each year, and 5,000 periodical titles are currently received. The bulk of this material is in the central Library on the Downtown Campus.

The central Library has developed strength in several fields. The collections in botany, chemistry, engineering, sociology, the Southern Appalachians, and West Virginia history are especially strong. Facilities for research in West Virginia and regional history are centered in the West Virginia Collection. In addition to an extensive collection of books, periodicals and maps, the collection contains over three million manuscripts. These, together with court records from many counties, are invaluable sources for the study of all aspects of West Virginia history.

The Rare Book Room contains an unusually fine collection of first and limited editions, including the four Shakespeare folios, and the first editions of many of the works of Dickens, Scott, and Clemens.

The Audio-Visual Department has some 1,800 educational films and 600 film-strips, as well as 3,000 recordings.

During regular sessions, except on holidays and vacations, the Library is open from 7:55 A.M. to 11:00 P.M., Monday through Thursday; Friday, from 7:55 A.M. to 10:00 P.M.; from 7:55 A.M. to 5:00 P.M., Saturdays; and from 2:00 P.M. to 10:00 P.M., Sundays. During the Summer Session the weekday hours are from 7:55 A.M. to 9:00 P.M.; and only the Reserve Collection is available on Sundays, from 2:00 P.M. to 5:00 P.M. During periods when the University is not in session, the hours are from 9:00 A.M. to 5:00 P.M., Monday through Friday; 9:00 A.M. to noon Saturdays; closed all day Sundays and holidays (New Year's Day, Memorial Day, July 4, Thanksgiving Day, and Christmas Day). Changes in scheduled hours are posted in advance.

The Agriculture-Engineering Library, located on the second floor of the Engineering Sciences Building on the Evansdale Campus, consists of approximately 40,000 volumes, for which a public card catalog is maintained. In addition, cards for titles in the library are filed in the central Library catalog and are marked "Ag-Eng." Titles in the Agriculture-Engineering Library may be obtained either at that library or by applying at the central Library circulation desk.

The Chemistry Library, consisting chiefly of bound periodicals in the field of chemistry, is located in Room 320 of the Chemistry Building. Catalog cards for these volumes are available there as well as in the central Library catalog marked "Chem-Lib."

The 70,000 volume Law Library is located on the second floor of the Law Building. University students may use this collection by applying at that library.

The Mathematics-Physics Library, located in Rooms 305-306, Physics Building, consists of approximately 7,000 volumes. Catalog cards for titles in the Mathematics-Physics Library are filed both in that library and in the central Library catalog and are marked "Math-Phys Lib."

The Medical Center Library is located on the second floor of the Basic Sciences Building on the Medical Center Campus. It contains some 71,000 volumes with a complete public catalog. Author cards for titles in the Medical Center Library appear in the central Library catalog. Titles in the Medical Center Library may be obtained by applying at the circulation desk of the central Library.

COMPUTER CENTER

The Computer Center is located in an annex to the Administration Building and is operated on a 24-hour-a-day basis with the IBM 1401 and 7040 computers currently installed. The 7040 is a 32K, high-speed binary computer capable of advanced scientific and engineering research computation, complex information retrieval and manipulation, and instructional operations. The 1401 is a powerful business data processing system used almost exclusively for University administrative applications.

A Computer Center library contains programs and literature. In addition a wide range of professionally written programs that have been adequately checked out and documented are available.

Statistical programs have been written by the Computer Center staff and others and are available for the 7040. These programs include, for example, chi square, correlation, regression, single and multiple regression, and frequency counts with percentages. Advice on the use of the various programs is available from the staff of the Computer Center.

BOOK STORES

The University operates on each campus a complete book and stationery store where students may purchase books, supplies, and professional equipment.

The store on the Downtown Campus is in the Book Store Building, with entrances from both Hunt Street and University Avenue but is expected to move into a wing of the new Mountainlair during the summer of 1967. The Medical Center store is in the Basic Sciences Building, ground floor, across from the snack bar. The Evansdale Campus store is in the Engineering Sciences Building, ground floor, across from the student lounge.

The stores offer the following specialized merchandise and service: new and used textbooks; out-of-print and antiquarian books and search service for those not in

stock; general books and paperbacks in all categories; art prints and artists' supplies; photographic equipment and supplies; medical and engineering instruments and supplies and University-seal imprinted gift items and wearing apparel.

UNIVERSITY PLACEMENT SERVICE

The University Placement Service provides vocational and job selection assistance to students and alumni.

In addition to registration procedures, which include counseling in the techniques of job application, the service assists alumni seeking promotion or change of position, and cooperates with all individuals and agencies interested in placement. It develops credentials for registered students and alumni, which include data furnished by the registrants as well as the references that are written in their behalf to support their search for employment, and furnishes these credentials to potential employers. A meeting place is provided for students seeking jobs, visiting company, governmental and educational representatives, and faculty members whose comments are sought by employers. A library is maintained which provides occupational and vocational information for use of advisers as well as students. The service analyzes the job market and tries to keep up with the development of new careers and the changes in the requirements of existing ones.

INFORMATION

The Central Information Desk for the University is located in the Administration Building lobby. Its chief services are to give directions to specific locations and to conduct tours of the campus for visitors. Arrangements for tours must be made in advance. Campus maps and printed announcements of University offerings and events are available there. The University Parking Committee uses the Information Desk for the distribution of application forms for parking permits and parking permit stickers. Visitors' parking permits are issued at this desk.

Information on student affairs, including Mountainlair offerings and the student cultural series, is available at the Mountainlair information desk.

CULTURAL ACTIVITIES

The University Cultural Series brings internationally recognized artists (e.g., the Budapest Quartet, Montoya), theater repertory and ballet companies, symphony orchestras, and choral groups to the campus. It is funded by a \$2.00 student fee. Admission to these events is free to all full-time students, on presentation of validated activity books.

Many cultural programs are presented without charge, including the convocation series which offers lecturers of national and international renown (e.g., W. H. Auden, Margaret Mead, Sir Bernard Lovell).

All performances of the resident artists, ensembles, some of the drama groups and the fine arts exhibitions of the University Creative Arts Center are offered without charge. These concerts and productions are recognized by connoisseurs, on and off campus, as generally reaching professional standards equal to the best on university campuses anywhere in the country. They include performances by resident artists, the University-Community Symphony Orchestra, the University Choirs, the University Choral Union, the American Arts Trio, the University Symphonic Band, Percussion Ensemble, Opera Theater, and senior and graduate student recitals. Fine arts exhibits are presented by the Division of Art and by Mountainlair. The drama productions of the University Players, for which season tickets or a ticket for each performance may be purchased at nominal prices, draw large audiences. Holders of Mountainlair cards may attend additional concerts, films, and lectures offered for students. The Film Society, sponsored by Mountainlair, regularly schedules showings of international cinema classics. The Creative Arts Center and all its productions are to be housed in a new building, including concert halls, theater, studios, and educational facilities, to be completed in 1968. Cultural events are publicized in the weekly Calendar of Events and special announcements. They are also announced in the *Daily Athenaeum*, the Morgantown newspapers, and by means of posters.

Graduate students who wish to participate in musical groups as performers should inquire of the Division of Music where there are many such opportunities.

Many distinguished scholars lecture at the University each year under the sponsorship of the Provost's Office, the academic departments, Phi Beta Kappa, and other

scholarly honoraries. These lectures are primarily directed to the specialized scholarly or professional interests of particular departments or colleges, but they are ordinarily open to members of the student body who may have an interest in them and they are so advertised.

STUDENT FINANCIAL AIDS

Information and guidance on the awarding of scholarships, loans, grants, awards, and prizes is available in the Financial Aids Office, Room 105, Martin Hall.

On-campus employment opportunities can be investigated at both the Financial Aids Office, Room 105, Martin Hall, and the Personnel Office of the University at 116 Willey Street.

Financial assistance for graduate students is usually based on initial recommendations by the department and school, division, or college in which the student is pursuing his studies. Information on fellowships and assistantships at the graduate level is available at these offices or at the Graduate School office, Room 104, Oglebay Hall. The following section summarizes many of these opportunities.

ASSISTANTSHIPS, FELLOWSHIPS, AND TRAINEESHIPS

Over one-third of the graduate students receive financial support through the University during the course of a year. There are over 300 graduate teaching assistantships supported mostly from State appropriations; over 150 graduate research assistantships financed through State or federal funds, private grants, and contracts; and about 200 fellowships and traineeships derived from federal programs such as HEA, NASA, NDEA, NIH, NSF, VA, etc. and from industrial and other non-public agencies.

Stipends for assistantships are generally stated in terms of 9 or 12 months' appointments for half-time service, *i.e.*, 20 hours service per week in the case of research assistantships, and the assisting with instruction of two courses or the equivalent in the case of teaching assistantships. Most fellowships and traineeships require enrollment for full-time study but no formal teaching or research duties. Tuition and registration fees are generally remitted. Departments may occasionally make appointments for more than or for less than half-time service with proportionately adjusted compensation. In the latter cases, the remission of tuition and registration fees is also reduced proportionately. Assistants giving half-time service may take no more than 12 credit hours in any one semester.

Applications should be made by the first week in March to the Dean of the College concerned; the Directors of the Office of Research and Development, Water Research Institute, and the Regional Research Institute; or in the case of Agriculture and Forestry, Arts and Sciences, Engineering, and Medical Sciences, to the Chairman of the Department in which the student's course work will be pursued.

AGRICULTURE AND FORESTRY

Graduate research assistantships at stipends of \$3,000 and \$3,600 for those holding Bachelor and Master Degrees respectively are available on a 12-month basis for half-time service, permitting a maximum of 12 hours per semester and waiving of tuition in the departments of Agricultural Biochemistry, Agricultural Engineering, Agronomy and Genetics, Animal Industry and Veterinary Science, and Plant Pathology, Bacteriology, and Entomology. Research assistantships at stipends of \$3,000 are available also in Agricultural Education, Forestry, and Horticulture.

Teaching assistantships at stipends of \$2,400 on a 9-month basis requiring half-time service, permitting a maximum of 12 hours per semester and waiving of tuition, are available in Agricultural Education, Agronomy and Genetics, Animal Industry and Veterinary Science, Forestry, Horticulture, and Plant Pathology, Bacteriology, and Entomology.

ARTS AND SCIENCES

Biology—Teaching assistantships up to \$2,400 for 9 months, half-time service, tuition and biology fees exempt. Research fellowships and assistantships with stipends comparable to teaching assistantships.

Chemistry—Teaching assistantships at \$2,400 for 9 months, half-time service, tuition and chemistry fees exempt. Research fellowships and assistantships supported

by contracts and grants from government, private and industrial sources. Stipends comparable to teaching assistantships.

English—Teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Foreign Languages—French, German, Spanish, Latin—Teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Geology—United States Steel Foundation Fellowship at \$2,400 for 9 months, tuition exempt. Teaching assistantships up to \$2,400 for 9 months, half-time service, tuition exempt. Research assistantships supported by contracts and grants. Stipends comparable to teaching assistantships.

History—Teaching assistantships, up to \$2,000 for 9 months, half-time service, tuition exempt.

Mathematics—Teaching assistantships up to \$2,200 for 9 months, half-time service, tuition exempt.

Philosophy—Assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Physics—Teaching assistantships up to \$2,400 for 9 months, half-time service, tuition exempt. Research assistantships supported by contracts and grants. Stipends comparable to teaching assistantships.

Political Science—Departmental assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Psychology—Psychometric and laboratory assistantships up to \$2,000 for 9 months, half-time service, tuition exempt. Also USPHS and VA Traineeships at standard stipends.

Sociology—Departmental assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Speech—Teaching assistantships, up to \$2,000, half-time service, tuition exempt.

CREATIVE ARTS (Art, Drama, Music)

Teaching, research, performance, and technical assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

COMMERCE

Business Administration and Economics—Teaching or research assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

ENGINEERING

Teaching fellowships in aerospace, chemical, civil, electrical, industrial, materials science, mechanical, nuclear engineering, and theoretical and applied mechanics, up to \$3,800 for 9 months, half-time service, tuition exempt. Air pollution control graduate traineeships from \$3,000 to \$3,600 for 12 months plus dependency allowance, tuition exempt.

ENGINEERING EXPERIMENT STATION

Research assistantships in aerospace, materials science, chemical, civil, electrical, industrial, mechanical, mining, nuclear, petroleum and geological engineering, and theoretical and applied mechanics. Stipends \$125 to \$300 per month for 9 or 12 months, half-time service, tuition exempt.

HUMAN RESOURCES AND EDUCATION

Clinical Studies—Research and teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Education—Research and teaching assistantships up to \$2,400 for 9 months, half-time service, tuition exempt.

Family Resources—Teaching assistantships at \$2,400 for 9 months, half-time service, tuition exempt.

Human Resources Research Institute—Research and teaching assistantships up to \$2,400 for 9 months, half-time service, tuition exempt.

Social Work—Graduate traineeships for master degree candidates. Stipends up to \$2,400 for 12 months, tuition exempt.

INSTITUTE OF BIOLOGICAL SCIENCES

Teaching assistantships will be available for qualified students.

JOURNALISM

Teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

MEDICAL SCIENCE

Support from training, research, and other grants in anatomy, biochemistry, microbiology, pharmacology, and physiology; stipends from \$2,400 to \$2,800 for 12 months. Additional allowances for dependents.

PHYSICAL EDUCATION

(INCLUDING HEALTH EDUCATION, RECREATION, AND SAFETY)

Teaching and research assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

REGIONAL RESEARCH INSTITUTE

A limited number of part-time research fellowships are awarded to graduate students who demonstrate a strong aptitude and interest in regionally-oriented basic research in the social sciences. Awards in variable amounts up to \$2,250 for 9 months, tuition exempt.

WEST VIRGINIA CENTER FOR APPALACHIAN STUDIES AND DEVELOPMENT

Office of Research and Development—Research assistantships up to \$2,250 for 9 months and \$3,000 for 12 months, half-time service, tuition exempt.

Water Research Institute—Research assistantships up to \$2,700 for 9 months and \$3,600 for 12 months, half-time service, tuition exempt.

DANFORTH GRADUATE FELLOWSHIPS

For men and women under 30 with no previous graduate study who wish to prepare for a career in college teaching. One year awards normally renewable for total of 4 years. Stipend up to \$2,200 with dependency and other allowances. Recommendations made during first semester of student's senior year by departments to Director of Student Educational Services.

DU PONT FELLOWSHIP IN CHEMISTRY

Inquire of Department of Chemistry.

HEA PROSPECTIVE TEACHER FELLOWSHIPS

A number of two-year fellowships are authorized for award through certain departments under Title V, Part C of the Higher Education Act of 1965 for full-time graduate study towards the master's degree. They are not awarded to experienced teachers but to U.S. citizen students seriously interested in a career in elementary or secondary education such as recent college graduates (baccalaureate degree not less than three years ago), other college graduates who have never taught, or other college graduates who have not taught in recent years.

Stipends are \$2,000 for the first academic year and \$2,200 for the second academic year plus allowances of \$400 for each eligible dependent. An additional stipend of \$400 plus \$100 for each eligible dependent is available for summer study.

Inquiries should be made of department of student's major.

KENT FELLOWSHIPS

For men and women under 30 with some graduate work preparing for teaching or administration in American colleges and universities. Applications obtainable direct

from Danforth Foundation, 607 North Grand Boulevard, St. Louis, Missouri 63103, for submission by December 17. Stipend up to \$2,800 with dependency and other allowances and renewal possible for total of 3 years.

MASONIC GRAND LODGE GRADUATE SCHOLARSHIPS

Two unrestricted scholarships of \$800 awarded each year. Inquire of University Scholarship Coordinator.

NASA PRE-DOCTORAL TRAINEESHIPS

A number of three-year pre-doctoral fellowships in space-related science and technology are supported by grants made by the National Aeronautics and Space Administration to the University. These carry basic stipends of \$2,400 plus an allowance of up to \$1,000 for dependents. Selection of trainees is made by a University Interdisciplinary Committee and is completed as soon as possible after grant award date of December 16 for start at the beginning of the next fall semester.

NDEA TITLE IV FELLOWSHIPS

The Office of Education, under provision of the National Defense Education Act of 1958, as amended, supports three-year pre-doctoral fellowships in departments recommended by the University and selected by the U. S. Commission of Education. Candidates must be U.S. citizens or have permanent residence status and must certify intention to pursue a full-time course of study leading to a doctoral degree and interest in a career in college or university teaching. Stipends vary from \$2,000 for first year to \$2,400 for third year, plus allowances of \$400 per year for each dependent. Nominations are recommended by approved departments after the grant award in November.

NSF GRADUATE TRAINEESHIPS

The National Science Foundation grants the University authority to select a number of trainees for study leading to master's or doctoral degrees in the biological, engineering, mathematical or physical sciences, anthropology, economics, geography, the history and philosophy of science, linguistics, political science, psychology, and sociology. Nominees must be U.S. citizens or nationals. Stipend is \$2,400 at first-year level, plus dependency allowance and opportunity of renewal. Nomination of trainees is by departments and selection is by a University interdisciplinary committee after the grant is awarded in January.

NSF GRADUATE FELLOWSHIPS

Available for U.S. citizens or nationals in the fields of mathematical, physical, medical, biological, and engineering sciences, geography, history, and philosophy of science, linguistics, political science, psychology, and sociology. The student applies directly to the Fellowship Office, National Academy of Sciences, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418. The student may select his own Graduate School, but it is his responsibility to obtain admission. Application deadline is about December 1.

OAK RIDGE FELLOWSHIPS

The opportunity to participate in the Graduate Fellowship Program of the Oak Ridge Institute of Nuclear Studies is open to qualified students in the fields of biology, chemistry, engineering, mathematics, physics, and other scientific fields. When certified by the University and after completion of his course work, the student has the opportunity to conduct research using the facilities of the Oak Ridge National Laboratory and other Oak Ridge facilities. The basic annual stipend is \$3,000 with an allowance of \$500 for each dependent. Tenure is for the last year of course work on-campus and/or the final dissertation year at the Oak Ridge National Laboratory. In some cases, graduate students may be offered the opportunity to acquire research experiences through summer appointments at Oak Ridge National Laboratory prior to the time they are qualified to receive a fellowship.

PUBLIC HEALTH SERVICE PREDOCTORAL FELLOWSHIPS

Available for U.S. citizens or those lawfully admitted to the U.S. for permanent residence having bachelor's degree or equivalent training. Graduate work must be in the basic sciences such as biology, chemistry, zoology, physiology, biochemistry, etc. as they relate to problems of health and disease. Among the social sciences, those areas such as psychology and sociology that relate to the problems of health and disease, and some interdisciplinary fields such as biostatistics, medical economics, cultural anthropology, etc. Stipend is \$2,400 at first year level with \$500 for each qualified dependent and certain travel expenses; up to \$2,800 for candidate in final year of doctorate program. Application by form from Chief, Career Development Review Branch, Division of Research Grants, National Institutes of Health, Bethesda, Maryland, 20014.

U.S. STEEL FELLOWSHIP IN GEOLOGY

Inquire of Department of Geology.

WOODROW WILSON NATIONAL FELLOWSHIPS

For first year of graduate study for students preparing for college teaching and particularly those majoring in the humanities or social sciences. Applicants nominated by a faculty member by October 31. Stipend \$2,000, tuition, and dependency allowance. Further information from Woodrow Wilson National Fellowship Foundation, Box 642, Princeton, New Jersey.

ADDITIONAL REFERENCE TO FELLOWSHIPS IN THE ARTS AND SCIENCES

Fellowships in the Arts and Sciences is an excellent source of information on sources of support for graduate study and research. On reference at the University Library and obtainable from American Council on Education, 1785 Massachusetts Avenue, N.W., Washington, D.C. 20036, for \$2.24.

Stipend Payment Dates For HEA, NASA, NDEA, and NSF Trainees and Fellows

The start of entitlement periods under these awards is usually September 1 of each year. Invoices for payments are prepared in the Office of the Graduate School each month between the 10th and the 15th for entitlements earned during that month. Checks are normally available at the Office of the Graduate School for the students on the first day of the next month. Students to receive stipends under these programs must arrange their finances accordingly for their needs from the start of the fall semester to October 1.

APPLICATIONS AND PROPOSALS FOR RESEARCH, DEMONSTRATION, AND TEACHING GRANTS

Numerous graduate assistantships for research, demonstration, and training projects are supported through funding by agencies and organizations outside the University. All proposals for these and also proposals for equipment and facilities must be submitted by the West Virginia University Board of Governors under cover and letter-head of the Board and signature of the President of the University whose full title is "President of the University and Chief Executive Officer of the Board of Governors".

Such proposals are prepared by members of the staff and carry the approval of their department chairman and budget officer, usually their academic dean. Proposals to the NIH and other agencies of the U.S. Public Health Service and all proposals to non-public agencies or organizations by Medical Center staff are reviewed and processed through the Vice President, Medical Center. All others are reviewed and processed by the Graduate School Office.

It is the responsibility of the person who prepares the proposal to adhere to the format recommended by the Graduate School Office, or to inform that office of any special format requirements of the grant source, to prepare copies in sufficient number, and to show the number of signed and unsigned copies to be forwarded, enclosures and special affidavits required, and deadlines to be met for proper consideration. Four additional copies of each proposal must be included for intra-University files. Letters of transmittal are prepared for the University President's signature by the Graduate School Office. The originator of each proposal must make sure that he follows the latest instructions and form required by the agency to which the proposal is to be submitted.

Part II

ACADEMIC INFORMATION AND REGULATIONS

The Graduate School was established by Board of Governors order in 1930 with the declaration that its "roots are implanted in all University undergraduate work, irrespective of colleges, schools, or departments. The Graduate School is empowered: (1) to direct research and investigation with particular reference to problems of the State, and (2) to train and recommend to the Board of Governors candidates for such graduate degrees as shall have been authorized." It follows that the Graduate School, as distinct from other colleges and schools, is a University-wide institution, drawing together all the faculties and students of the University concerned with graduate study, and empowered to establish: policies and regulations covering the introduction of degree programs; degree, curricular, thesis, and dissertation requirements; standards of student scholarship; residency rules, etc., which take precedence over the policies and rules of particular colleges, schools, and departments.

All decisions on major policies and regulations affecting graduate study and the introduction of new degree programs are based on recommendations made by the Graduate Faculty, after study and advice by the Executive Committee of the Graduate Faculty and the Dean of the Graduate School. Responsibility for determining graduate faculty membership is essentially in the hands of the Executive Committee, acting on recommendation from the staff member's department chairman and academic college dean. The Executive Committee consists of six members, the Dean and Assistant Dean, *ex officio*, and four graduate faculty members elected at large by the graduate faculty for staggered terms of four years. The Executive Committee normally meets once a month and calls meetings of the Graduate Faculty twice during the academic year.

In practice, much of the day-to-day administration of graduate study is conducted by the departmental chairman or graduate advisers responsible for the particular programs. At the University level, responsibility for administration of the graduate faculty's policies and regulations, resolving problems of interpretation of these rules, keeping student records, and preparing graduation lists is vested in the first instance in the Assistant Dean of the Graduate School (Graduate School Office, Room 104, Oglebay Hall).

Two copies of *all* documents concerning a graduate student (on admissions, appointment of committees, announcement of qualifying and final examinations, etc.) are required, one to be forwarded to the office of the Graduate School for approval and/or inclusion in the student's file there, and the other to be included in the student's file in the Department of the student's major.

ADMISSIONS

GENERAL

Prospective graduate students are strongly urged to initiate their admission applications as early as possible. March application for September admission is reasonable procedure.

Students are officially admitted to the Graduate School through the Office of Admissions. A student who plans to undertake a specific graduate degree program must in addition, be approved for this by the Department offering the program. Any graduate of an accredited baccalaureate institution *may* be admitted to the Graduate School, but requirements of some Departments for following a degree program are more restrictive than those of the Graduate School which are kept broad enough to permit the enrollment of qualified students who want to undertake limited, non-degree programs of graduate study.

Application for admission must be made on standard forms obtainable from the Office of Admissions. The completed application forms must be submitted to the Director of Admissions of the University accompanied by payment of a non-refundable special service fee of \$10.00. The applicant must at the same time request the registrar of the college of his baccalaureate to send an official transcript of his record directly to the Director of Admissions. The applications and transcript should be received at least one month in advance of registration.

The Director of Admissions will forward the application to the Dean of the Graduate School and to the department of the student's choice. The student will be informed at the time he is admitted to Graduate School whether or not the department will approve his pursuing a degree program and any conditions thereof. Approval is then conditional upon receipt of a complete official final transcript.

GRADUATE RECORD EXAMINATION

All students entering the Graduate School who have not already earned a graduate degree are required to take the aptitude test of the Graduate Record Examination (GRE) before admission or, at the latest, during the first semester of enrollment. The College of Human Resources and Education and certain departments of other colleges require GRE scores from all of their graduate students including those with a previous graduate degree. Some departments require scores *both* from the aptitude tests and the appropriate advanced test before making a decision on the admission application.

Students should arrange to take the aptitude test and, if required by the major department, the appropriate advanced test prior to their first graduate registration at the University and should request the Educational Testing Service to forward their scores to the Dean of the Graduate School. Students who are unable to do this will be admitted to the Graduate School provisionally and must take the GRE on the first date that it is offered on the West Virginia University campus.

Those planning to take the examination must send completed forms to the Educational Testing Service, Princeton, New Jersey, at least fifteen days prior to the date of the examination. The forms and examination dates are a part of the GRE information packet available at the WVU Graduate School Office or at other college centers throughout the country. The fee for the aptitude examination is \$7.00; for an advanced examination, \$8.00; and for both examinations, if taken on the same day, \$12.00.

FOREIGN STUDENTS

All foreign student applications for admission must be submitted to the Director of Admissions with a score on "The Test of English as a Second Language (TOEFL)" at least four months in advance of the proposed date of entry. Information on location of testing centers, dates of testing, and application forms should be obtained from TOEFL, Educational Testing Service, Princeton, N. J. 08540, U.S.A.

CLASSIFICATION OF GRADUATE STUDENTS

An eligible student who wishes to further his education beyond the baccalaureate without becoming a candidate for any degree may be admitted to the Graduate School as a "*Special Graduate Student*." A "*Graduate Student*" is a student who has been admitted by the Office of Admissions to pursue a degree program by the department of his choice. A "*Full-time Graduate Student*" is one who is registered for 12 or more semester hours of course work each semester of the regular academic year, or 9 or more semester hours during the summer session. Students in the above categories who have been placed on academic probation by their departments, scholarship committees, or by the Graduate School are "*Probationary Graduate Students*." A student who fails to satisfy the conditions of his probation is subject to suspension.

A student who is suspended from a degree program may petition for reinstatement in the Graduate School upon recommendation by a different department for his classification as a graduate student or as a probationary graduate student. A student who has not been accepted as a graduate student by the department of his choice or a student who has been suspended from a degree program may not enroll in courses which are a part of that degree program without permission of the department chairman. If he enrolls in such courses, his enrollment may be withdrawn.

SUBMATRICULATE GRADUATE CREDIT

Seniors in the colleges of West Virginia University and in colleges where West Virginia University offers graduate courses by extension who are within 10 semester hours of graduation may, with the prior approval of the Dean of the Graduate School on special senior petition forms, enroll for graduate courses for which they may receive graduate credit after obtaining the baccalaureate and after being admitted to the

Graduate School. Such graduate courses must not have been offered for undergraduate credit, and in every case the petition must have been approved before or at the time of enrolling for the course or courses. The maximum amount of graduate credit permitted under this regulation is 15 hours. Combined graduate and undergraduate credit must not exceed 18 hours in one semester or 12 hours in the summer session.

THE ADVISER

Each department or other academic unit through which graduate degree programs are administered has one or more graduate advisers who are members of the graduate faculty. Every graduate student is assigned to such an adviser who arranges a specific program of study with the student as early as possible before or after his first enrollment. The program is subject to approval by the Dean of the Graduate School and made a part of the student's records. The adviser will preside at the student's qualifying and final examinations.

REGISTRATION REQUIREMENT

Each graduate student in residence, whether taking course work, engaged in conducting research, or writing a report, thesis, or dissertation, must register at the beginning of each semester or summer session during which graduate work is being done. He must also be registered during the semester or session in which he takes the final examination. Under exceptional conditions and with the prior approval of the Dean, a graduate student may be permitted to meet a portion of the requirements for the degree in *absentia*, provided the customary residence and other requirements are met.

CANDIDACY

Admission to candidacy for any graduate degree is an additional requirement over and above admission to the Graduate School and admission to a graduate program in a particular department, school, or college. A candidate for a graduate degree is a student who has satisfactorily completed a suitable period of graduate work in residence in which ability to do work of graduate caliber is demonstrated to the satisfaction of his adviser and graduate committee. It is usually established by successful completion of a departmental qualifying examination as further explained in the following pages under requirements for the Master's degree, the Doctor's degree, and in Part IV of these *Announcements*.

CREDIT LIMITATIONS

GENERAL

Credit toward a graduate degree may be obtained only for courses listed in these *Announcements* and numbered 200-399. No residence credit will be allowed for special field assignments or other work taken off the university campus without prior approval by the Dean of the Graduate School.

No more than 15 hours of graduate courses in any one semester or more than 12 hours of graduate courses in any one summer session may be carried by a student. Any exception to this rule must be approved by the Dean of the Graduate School.

TRANSFER CREDIT

No more than 6 hours of graduate credit obtained at other approved institutions may be considered for transfer toward meeting the requirements for the Master's degree at West Virginia University. Approval in writing from the Dean of the Graduate School must be secured in advance to take graduate courses offered elsewhere. Credit will not be established until the student has successfully completed at least 12 semester hours of graduate work at West Virginia University. Graduate credits so accepted must meet requirements for a continuous and unified program of graduate study. They will reduce correspondingly the number of hours of extension graduate credits which may be accepted toward meeting the requirements for the Master's degree. The total of transfer plus extension credits applicable toward the degree is 15.

The above regulation applies to all Master's degrees based on a total credit re-

quirement of 30 to 46 semester hours. The degree of Master of Social Work is based on a total credit requirement of 54 to 60 semester hours, 24 to 30 of which may be transferred under suitable conditions, but the last 30 of which must be earned and completed at West Virginia University.

EXTENSION CREDIT

No credits earned by extension prior to admission to the Graduate School and acceptance to a degree program of graduate study may be counted toward the Master's degree except under the submatriculate (senior petition) regulation. No more than 15 hours of extension credit or combination of extension credit and transfer credit may be counted toward the Master's degree.

For majors in the Division of Education of the College of Human Resources and Education no more than 9 of the 15 hours allowable toward the Master's degree may be obtained before the student completes at least 6 hours in residence on the campus. Full-time in-service teachers may obtain no more than 9 semester hours of credit toward the Master's degree in any one academic year. The maximum amount of extension graduate credit that may be received in any one field is 9 semester hours.

EMPLOYED GRADUATE STUDENTS

Graduate students will be required by their advisers to limit their credit loads in proportion to the outside service rendered and the time available for graduate study. In general, persons in full-time service to the University, or other employer, will be advised to enroll for no more than 6 hours of work in any one semester and those in half-time service for no more than 12 hours. ✓

MAXIMUM TIME FOR COMPLETION

Completion of requirements for any graduate degree must be accomplished within a period of 7 years. For a Master's degree the period starts at the initial enrollment for a graduate course after the Bachelor's degree is conferred. The same is true for a Doctoral degree, although when there is an intervening award of a Master's degree the seven year period for completion of the Doctorate starts at the initial enrollment for a graduate course after the Master's degree is conferred. Credits lost at the beginning of a graduate program under this regulation will not usually be considered for revalidation and then only upon formal petition to the Dean of the Graduate School by the student's graduate adviser or committee chairman.

SCHOLARSHIP

No credits are acceptable toward a graduate degree which are reported with a grade lower than "C".

Reasonable standards of oral and written English must be maintained.

To be in good standing, a graduate student must maintain a cumulative grade point average of 2.0. A student whose grade point average falls below 2.0 will be placed on probation and required to remove the deficiency within the next twelve hours for which he enrolls. If he fails to do so, he will be suspended from the Graduate School. A student who fails more than one-half of the work for which he is enrolled during any semester or summer session will be suspended. This regulation is a minimum standard for the Graduate School and the higher scholarship requirements of most departments must also be met.

PROBLEM REPORTS, THESES, AND DISSERTATIONS

These shall be presented to the student's departmental graduate adviser or committee chairman at least one month before the end of the semester or summer session in which completion of all requirements is expected. The form prescribed under the Graduate School "Regulations Governing the Preparation of Dissertations, Theses, and Problem Reports" must be followed with the guidance of the student's graduate adviser or chairman of the student's graduate committee. In order for the manuscript to be approved there shall be no more than one unfavorable vote among members of the student's committee. Two accepted copies in approved typewritten form (problem reports and theses in bound form and dissertation unbound) shall be delivered to the

Office of the Graduate School at least one week before the end of the semester or summer session in which the graduate program is to be completed. Additional regulations are described under specific degree requirements in the following pages.

FINAL EXAMINATIONS

The final examination shall not be given until the semester or summer session in which all other requirements for the degree are to be met. In programs requiring a problem report, thesis, or dissertation the final examination must follow committee approval of the manuscript. The student's adviser or committee chairman must notify the Office of the Graduate School in advance of the time, place, and recommended examining committee membership. Examining committees shall be comprised of no fewer than three members for the Master's degree and no fewer than five members for the Doctor's degree. All but one must be members of the Graduate Faculty and it is customary to have at least one member from a department other than that of the student's major field. The student cannot be considered as having satisfactorily passed the final examination if there is more than one unfavorable vote among members of the examining committee. Results of each examination must be reported to the Office of the Graduate School. Re-examination may not be scheduled without approval of the Dean of the Graduate School.

REQUEST FOR DEGREE

At the time of registration for the semester or the summer session in which all degree requirements are expected to be met, each candidate shall submit a formal request on a special form to the Dean of the Graduate School for the conferring of the degree. The candidate must have completed all requirements at least one week before the end of that semester or summer session.

COMMENCEMENT ATTENDANCE

Candidates for degrees to be conferred at the close of the second semester are expected to be present in person to receive their diplomas by participating in the Commencement exercises.

THE DEGREES OF MASTER OF ARTS AND MASTER OF SCIENCE

REQUIREMENTS

General: The regulations governing admission, registration, establishment of candidacy, scholarship, thesis and problem reports, final examinations, etc. described in the preceding sections must be followed.

Program: No less than 30 hours of graduate work planned with the student's graduate adviser must be satisfactorily completed within a period of seven years immediately preceding the conferring of the degree. In degree programs requiring a thesis or problem report, appropriate courses may be taken to cover the research and writing, but no more than 6 hours of credit earned for research or thesis may be counted in meeting course requirements for the degree. In most departments the program consists of certain amounts of work in major and minor fields. These are described in the departmental programs of Part IV in this bulletin.

Residence: A minimum total of residence in full-time graduate study at West Virginia University consisting of two semesters, or of one semester and one summer session, or of two summer sessions is required. For students offering 15 credit hours in extension, the minimum period of full-time graduate study in residence at West Virginia University is one semester or one summer session.

Special: Each student, through consultation with his graduate adviser, must meet the special requirements of the department in which he pursues his major study, subject to approval of the Dean of the Graduate School.

DEGREES

Fields or Departments through which these degrees are offered are as follows:

Master of Arts (A.M.) with a major in:

Art	Latin
Biology	Latin American Area Studies
Classics	Library Science
Counseling and Guidance	Mathematics
Drama	Philosophy
Economics	Political Science
Education	Psychology
English	Reading
French	Sociology
Geology	Spanish
German	Special Education
History	Speech

Master of Science (M.S.) with a major in:

Agricultural Microbiology	Geology
Agricultural Bacteriology	Health Education
Agricultural Biochemistry	Horticulture
Agricultural Economics	Industrial Relations
Agricultural Education	Mathematics
Agronomy	Microbiology (Medical Bacteriology)
Anatomy	Pharmacology
Animal Breeding and Genetics	Physical Education
Animal Nutrition	Physics
Animal Physiology	Physiology
Animal Production	Plant Pathology
Veterinary Science	Poultry Science
Biochemistry (Medical)	Recreation
Botany	Rehabilitation Counseling
Business Administration	Reproductive Physiology
Chemistry	Safety Education
Economics	Speech Pathology and Audiology
Entomology	Vocational Agriculture
Food Science	Wood Science and Technology
Genetics	Zoology

Master of Science in the following designated fields:

Aerospace Engineering (M.S.A.E.)	Home Economics Education
Agricultural Engineering (M.S.Ag.E.)	(M.S.H.Ec.Ed.)
Chemical Engineering (M.S.Ch.E.)	Industrial Engineering (M.S.I.E.)
Civil Engineering (M.S.C.E.)	Journalism (M.S.J.)
Electrical Engineering (M.S.E.E.)	Mechanical Engineering (M.S.M.E.)
Engineering (M.S.E.)	Mechanics (M.S.T.A.M.)
Extension Education (M.S.Ext.Ed.)	Engineering of Mines (M.S.E.M.)
Forestry (M.S.F.)	Petroleum Engineering (M.S.Pet.E.)
Home Economics (M.S.H.E.)	Nuclear Engineering (M.S.N.E.)

Other designated Master's degrees:

Master of Agriculture (M.Ag.)
Master of Business Administration (M.B.A.)
Master of Home Economics (M.H.E.)
Master of Music (M.M.)
Master of Social Work (M.S.W.)

THE CERTIFICATE OF ADVANCED STUDY

This Certificate is conferred for successful completion of a program through the College of Human Resources and Education for students who have a Master's degree (see page 180).

THE DEGREE OF DOCTOR OF PHILOSOPHY

GENERAL REQUIREMENTS

The regulations governing admission, registration, scholarship, etc., described in the preceding sections must be followed. Students applying for admission to a doctoral program after having received a Master's degree at West Virginia University must file a new completed form for admission to the Graduate School with the Office of Admissions. This is to insure the intent and proper records of the student and does not entail an additional admissions special service fee.

CANDIDACY REQUIREMENTS

Admission to the Graduate School and enrollment in graduate courses does not of itself imply acceptance of the student as a candidate for a Ph.D. degree. This is only accomplished by (1) satisfactorily passing a comprehensive preliminary or qualifying examination (either oral, or written, or both) and (2) by meeting the Ph.D. language requirements.

(1). *Qualifying Examination:* After a period of residence the student will be admitted to a comprehensive examination in which he must demonstrate a grasp of the important phases and problems of the field of study in which he proposes to major; their relation to other fields of human knowledge and accomplishments; and the ability to employ rationally the instruments of research that have been developed in his major field. The scheduling and results of each such examination must be reported to the Office of the Graduate School.

(2). *Foreign Language Examinations:* The basic foreign language requirement is that the student demonstrate the ability to read French and German in a satisfactory manner.

One or more other foreign languages in which there exists a significant literature in the student's major field of study, and which are acceptable to the student's major department and to the Dean of the Graduate School may be substituted for those specified.

Language examinations are arranged by the Foreign Language Examiner who is a member of the faculty and is appointed by the Dean of the Graduate School with the advice of the chairman of the Department of Foreign Languages. Examinations are administered by a person or persons selected by the Foreign Language Examiner at stated times, in general, twice each semester and once during the summer. Material in the student's field of specialization is approved by the adviser, and the student is allowed to prepare in advance for examination of this material. When translating unfamiliar material, the student will be allowed to use a dictionary. If a student fails the examination, his adviser may request a review of his examination papers. This review will be conducted by a committee of three members appointed by the Dean of the Graduate School. One member of the committee shall be a member of the faculty of the Department of Foreign Languages. The Foreign Language Examiner shall report to the student's adviser and to the Dean of the Graduate School the results of language examinations and examination reviews.

The student's major department may petition the Dean of the Graduate School for approval of course work, other than that which might reasonably be a normal program requirement, as a substitute for one language only.

The completion of 12 semester hours or equivalent of course work in an approved foreign language with a grade of B or better in the last three hours at West Virginia University or at any other graduate institution of recognized standing, will be accepted as satisfying the reading requirement of a language, provided that it was completed no more than three years prior to application for language certification. The reading requirements of one or both languages may be satisfied in this way but must be approved by the Foreign Language Examiner.

The completion of French 206 at West Virginia University with a grade of B or better as a graduate student or within two years of applying for language certification will be accepted as satisfying the reading requirement in French.

When a student has successfully completed his qualifying examination and has satisfied his foreign language requirements he is promoted to candidacy for the Ph.D.

PROGRAM

The program of Ph.D. study is planned with the student's graduate adviser and committee to combine any or all of the following: Graduate courses of instruction, special seminars, independent study, supervised research, and supervised teaching designed to promote a broad and systematic knowledge of his field and to prepare the student for the comprehensive qualifying and final examinations and writing of the dissertation.

RESIDENCE

The program for the Ph.D. generally requires at least three years of full-time graduate work beyond the Bachelor's Degree. This must include a minimum of two semesters of residence in full-time graduate study, or its equivalent, at West Virginia University.

DISSERTATION

The candidate must submit a dissertation pursued under the direction of the faculty of this University on some topic in the field of the major subject. The dissertation must present the results of the candidate's individual investigation and must embody a definite contribution to knowledge. While conducting research or writing a dissertation the student must register at the beginning of each semester or summer session during which credit is being earned.

SPECIAL REQUIREMENTS

The student must satisfy such special requirements, subject to the approval of the Dean of the Graduate School, as may be required by the faculty of the college, school, or department of his major field. All of the requirements for the degree shall be completed within a period of seven years.

FINAL EXAMINATION

If the candidate's dissertation is approved and he has fulfilled all other requirements, he will be admitted, upon approval by the Dean of the Graduate School, to a final oral examination on his dissertation before his examining committee. At the option of the department or the committee, a comprehensive final written examination also may be required. Results of the examination, acceptance of the dissertation, and certification of its suitability for immediate publication must be reported by the committee chairman to the Office of the Graduate School not later than one week before the end of the semester or summer session in which the degree is expected to be granted.

PUBLICATION OF THE DISSERTATION

All Ph.D. and other Doctoral Dissertations and their abstracts will be microfilmed through University Microfilms, Ann Arbor, Michigan. This requirement will not be satisfied by any other publication but does not preclude publication elsewhere which is both permitted and encouraged.

Candidates are to follow "Regulations Governing the Preparation of Dissertations, Theses, and Problem Reports" regarding format, paper, and organization of the dissertation and "A Review of Copyright Matters Related to Graduate Theses and Dissertations" for information pertaining to copyrights. Both of these papers are on file at the Office of the Graduate School, Department offices, offices of all Graduate Advisers, and the University Libraries. The candidate is required to maintain close contact with his supervisor or chairman of his graduate committee on these matters in developing his dissertation so as to incorporate the special requirements of the subject discipline.

One week before the close of the semester or summer session in which the degree is expected to be conferred the candidate must:

1. Submit to the Office of the Graduate School, in form satisfactory for microfilming, the typewritten, unbound original and first carbon copy of the dissertation signed by the candidate's committee. Two excellent machine-reproduced copies may be acceptable.

2. Submit to the Office of the Graduate School one abstract as above of the dissertation consisting of no more than 600 words.
3. Submit to the Office of the Graduate School a microfilm contract completed and signed by the candidate.
4. Pay a fee of \$30.00 at the Office of the Graduate School to cover the cost of microfilming the dissertation and publication of the abstract in *Dissertation Abstracts*, a bi-monthly journal which receives wide distribution. Check must be made out to "Dissertation Service." If copyright service is desired, it can be provided through the Office of the Graduate School upon receipt of a certified check for \$12.75 made payable to "University Microfilms."
5. Complete the questionnaire entitled "Survey of Earned Doctorates" obtained at the Office of the Graduate School and return it there.

MAJOR FIELDS

Programs toward the Ph.D. are offered in the following major fields:

Aerospace Engineering	Genetics
Agronomy	Geology
Agricultural Biochemistry	History
Agricultural Microbiology	Mechanical Engineering
Anatomy	Microbiology (Medical)
Animal Nutrition	Music
Biochemistry (Medical)	Pharmacology
Biology	Physiology
Botany	Physics
Chemical Engineering	Plant Pathology
Chemistry	Political Science
Civil Engineering	Psychology
Economics	Reproductive Physiology
Electrical Engineering	Theoretical and Applied Mechanics
Engineering	Zoology

THE DEGREE OF DOCTOR OF EDUCATION

The degree of Doctor of Education is offered through the College of Human Resources and Education. Programs leading to the degree with a major in Music Education are offered cooperatively with the Creative Arts Center (see p. 111) and those leading to the degree with a major in Health Education, Physical Education, or Safety Education are offered cooperatively with the School of Physical Education (see p. 222). The major fields are:

Curriculum and Instruction	Physical Education
Educational Administration	Reading
Guidance and Counseling	Safety Education
Health Education	Special Education
Music Education	Speech Pathology and Audiology

THE DEGREE OF DOCTOR OF MUSICAL ARTS

The degree of Doctor of Musical Arts is offered through the Creative Arts Center. The degree program is described on page 114.

Part III

FINANCIAL INFORMATION AND REGULATIONS

FEES AND EXPENSES

All University fees are subject to change without notice.

A non-refundable special service fee of \$10.00 must accompany applications for admission to the Graduate School.

All fees are due and payable at the Comptroller's desk in the Field House Annex (South) on the days of registration. Students must pay fees before registration is accepted and class tickets are released. Completion of arrangements for payment from University payroll checks, officially accepted scholarships, loan funds, grants or contracts shall be considered sufficient for acceptance of registration. Fees paid after regular registration must be paid at the Comptroller's office in the Administration Building. Any student failing to complete registration on regular registration days is subject to the Late Registration Fee of \$10.00. Students registering pay the fees shown on page 42, plus special fees and deposits as required.

By order of the Board of Governors, no degree will be conferred upon any candidate prior to payment of all tuition, fees, and other indebtedness to any unit of the University.

SPECIAL FEES

Late-registration Fee (non-refundable) ¹	\$ 10.00
Graduation Fee ²	10.00
Professional Engineering Degree (including \$10 graduation fee)	25.00
Student's Record Fee ³	1.00
Fee for Change in Registration (after 8th day)	1.00
Fee for Examination for Entrance Credit, per unit	1.00
Fee for Examination for Advanced Standing	3.00
Fee for General Educational Development Tests (high-school level) ⁴	15.00
Certificate of Advanced Study in Education	2.00
Fee for Reinstatement of Students Dropped From the Rolls	3.00
Fee for Examination of Candidates for Graduate Degree ⁵	1.00
Diploma Replacement Fee	5.00
Physical Education Student Fee	5.00
Student Identification Card Replacement Fee	1.00
Correspondence Course in Guided Reading (per course)	1.00
Driver Education Laboratory Fee	10.00
Labor Education Service (for informal activities)	2.00-10.00
Social Work Field Supervisory Fee (per year)	75.00

FEES FOR EXTENSION COURSES

A fee of \$12.00 per semester hour and an off-campus extension fee of \$12.00 per course are charged for enrollment in each extension course. Fees for extension courses are due and payable at or prior to the first class meeting.

¹This fee is not charged to students who complete registration during the regular registration days as set forth in the University Calendar. This fee became effective September 1, 1960.

²The Graduation Fee is payable by all students at the beginning of the semester or session in which they expect to receive their degrees.

³One transcript of a student's record is furnished by the Registrar without charge. This fee is charged for furnishing an additional transcript.

⁴If the applicant applies for admission to and registers in the University within twelve months of the date for his qualifying for the test, a \$10.00 credit shall be established for him.

⁵For graduate students not otherwise enrolled at time of final examination.

FEES FOR UNDERGRADUATE AND GRADUATE MUSIC STUDENTS

FULL-TIME

Resident students	\$140.00 per semester
Non-resident students	\$455.00 per semester

PART-TIME

Resident students	\$ 8.00 per semester hour (includes \$4.00 per semester hour Registration Fee.)
Non-resident students	\$32.00 per semester hour (includes \$16.00 per semester hour Registration Fee.)

Full-time or part-time students registered for Bachelors' or advanced degrees in Music or the Supervisory Training Program in Music shall pay the regular full-time or part-time tuition and Registration Fee for all courses in music. No additional fees are assessed for Applied Music.

Students registered in other colleges or schools, including the Graduate School, may enroll in class courses in music at the regular full-time or part-time fee per credit hour. These students may also enroll for Applied Music for a maximum of one half-hour lesson per week for one hour credit. The fee for this Applied Music instruction shall be \$20.00 in addition to the aforementioned tuition and registration fee. See the University *Undergraduate Catalog* for additional details on fees.

STUDENT UNION FEE AND DAILY ATHENAEUM FEE

Effective with the beginning of the 1967 Summer Session, the following fees will be charged all students, full-time and part-time, who are enrolled for regular courses of resident instruction at West Virginia University in Morgantown:

Student Union Fee	\$20.00 per semester
Daily Athenaeum Fee	\$ 1.50 per semester
Student Union Fee	\$12.00 per full Summer Session
Daily Athenaeum Fee	\$ 1.00 per full Summer Session

These fees are non-refundable unless the student withdraws officially before the close of General Registration for the term or course in which he has been enrolled.

SUMMER SESSION FEES

	<i>Resident</i>	<i>Non-Resident</i>
Tuition, per semester hour (Agriculture and Forestry; Arts and Sciences; Commerce; Creative Arts Center; Engineering; Human Resources and Education; Journalism; Mines; Physical Education)	\$ 8.00*	\$32.00**
Tuition, per semester hour (Dental Hygiene, Law, Medical Technology, Nursing, Pharmacy)	9.00*	33.00**
Tuition, per semester hour (Dentistry and Medicine)	12.00*	42.00**
Daily Athenaeum Fee††	1.00	1.00
Health and Counseling Service Fee†	7.00	7.00
Student Union Fee††	12.00	12.00
Student Educational Services Fee†	2.00	2.00
University Fee†	2.00	2.00

*Includes \$4.00 per semester hour Registration Fee.

**Includes \$16.00 per semester hour Registration Fee.

†Non-refundable fees required of full-time students. May be paid by part-time students who desire the services. Part-time students who elect to pay these fees must pay the same amount assessed full-time students.

††Fee required of all students. (Non-refundable unless student withdraws officially before the close of general registration).

REMISSION OF FEES

The tuition fee and registration fee will be remitted to a person registered in the Graduate School or the College of Law and who is employed by the University on a regular appointment approved by the Board of Governors, subject to the following:

(a) There will be no remission of the Daily Athenaeum fee or of the Student Union fee. These fees are charged all students, full-time and part-time, who are enrolled for regular courses of resident instruction.

(b) Except as provided in "c", a graduate teaching or graduate research assistant will receive remission of tuition fee and registration fee commensurate with the hours of service required by the terms of his appointment.

(c) A faculty member on full time appointment at any recognized institution of higher learning located in West Virginia who is taking a course of graduate study at the University and holds an appointment as a graduate assistant under the terms of Order No. 3071 of the Board of Governors will receive full remission of tuition fee and registration fee.

(d) A regular appointment is effective at the beginning of a semester or summer session. Exemption from tuition fee and registration fee must be claimed at the beginning of the registration period or, in the case of a substitute appointment, within ten days after the appointment has been made.

(e) An employee who holds a regular appointment and is eligible for remission of tuition fee and registration fee in the second semester of any regular academic year is also eligible for remission of tuition fee and registration fee in the summer session immediately following his term of appointment.

In certain cases an employee on regular University appointment approved by the Board of Governors, may be permitted to register in the Graduate School or the College of Law for 12 credit hours or more in one semester, or for 9 credit hours or more in a full summer session. If such an employee does register for such number of credit hours and qualifies for remission of tuition fee and registration fee, he shall not be subject to the Special Services fees, except the Daily Athenaeum fee and the Student Union fee, but must pay such fees to be entitled to the services provided thereby. Such employees do not receive the Student Identification Card which provides for athletic admissions, student educational services, health and counseling, etc.

The wife (or husband) of any person employed full-time by the West Virginia University Board of Governors for a faculty position with the rank of instructor or above, or for a research position of equivalent rank, or as the administrative head of a University division, or as an assistant administrative head, shall be charged the same fee as resident students. The dependent children of the person so employed shall also be charged the same fees as resident students.

Effective from the date of employment, any full-time employee of West Virginia University on a regular appointment approved by the Board of Governors shall be charged the same tuition and fees as resident students.

SERVICE CHARGE ON RETURNED CHECKS

A service charge of 5 per cent of the amount of each check returned unpaid by the bank upon which it is drawn shall be collected unless the student can obtain an admission of error from the bank.

If the check returned by the bank was in payment of University and registration fees, the Comptroller's office shall declare the fees unpaid and registration cancelled if the check has not been redeemed within three days from date of written notice. In such a case the student may be reinstated upon redemption of the check, payment of the 5 per cent service charge, and payment of a late payment fee of \$10.00.

SEMESTER FEES IN THE COLLEGES AND SCHOOLS

(See Footnotes 6, 7, 8, 9, 10)

	Full Time		Part Time (Per Semester Hour)	
	Resident	Nonresident	Resident	Nonresident
GROUP I				
Agr. and For.				
Arts and Sciences				
Commerce				
Creative Arts Center (Music, Art, Drama)	\$90.00* Fee of \$50.00.	Registration Fee of \$200.00.	\$255.00* plus Registration Fee of \$200.00.	\$8.00** per semester hour.
Engineering				
Human Resources and Education				
Journalism				
Mines				
Physical Education				
GROUP II				
Dental Hygiene				
Law				
Medical Technology (Jr. and Sr. Years)	\$105.00* Fee of \$50.00.	Registration Fee of \$200.00.	\$280.00* plus Registration Fee of \$200.00.	\$9.00** per semester hour.
Nursing				
Pharmacy				
GROUP III				
Dentistry	\$167.00* Fee of \$50.00.	Registration Fee of \$200.00.	\$385.00* plus Registration Fee of \$200.00.	\$12.00** per semester hour.
Medicine				

* Includes Athletics Fee \$8.25; Student Educational Services Fee \$4.00; Daily Athenaeum \$1.50; Health and Counseling Services Fee \$12.00; Student Union Fee \$20.00; University Fee \$4.25.

** Includes \$4.00 per semester hour Registration Fee.

*** Includes \$16.00 per semester hour Registration Fee.

Parkersburg Center of West Virginia University: \$20.00 per semester hour.
Kanawha Valley Graduate Center (Institute, W. Va.): \$50.00 per semester hour.

REFUNDING OF FEES

A student who officially withdraws from the University may arrange for a refund of fees by submitting to the University Comptroller evidence of approval of the refund by the Registrar.

To withdraw officially a student must apply to the Registrar for permission. Semester fees will be returned in accordance with the following schedule:

First refund period ending on the second Saturday following the beginning of General Registration.

Second refund period ending on the fourth Saturday following the beginning of General Registration.

Third refund period ending on the sixth Saturday following the beginning of General Registration.

Last refund period ending on the eighth Saturday following the beginning of General Registration.

*Charged for
per week
68*

⁶A full-time graduate student is one who is registered for 12 or more semester hours of work each semester of the regular academic year, or 9 or more semester hours of work during the Summer Session. A full-time student during the regular academic year receives an Identification Card which entitles him to admission to all athletic events. A full-time student during the regular academic year or during the Summer Session is entitled to free medical consultation and advice from the University physician. A moderate charge is made for room calls, X-rays, special laboratory tests, drugs furnished by the University Pharmacy, minor operations, treatment of fractures and dislocations, and intravenous treatment.

⁷A part-time graduate student is one who is registered for fewer than 12 semester hours per semester during the regular academic year, or for fewer than 9 semester hours during the Summer Session.

⁸No person shall be considered eligible to register in the University as a resident student who has not been domiciled in the State of West Virginia for at least twelve consecutive months next preceding college registration. No non-resident student may establish domicile in this State, entitling him to reduction or exemptions of tuition, merely by his attendance as a full-time student at any institution of learning in the State. A minor student whose parents acquire a West Virginia domicile after the student's original registration will be deemed to have the domicile of his parents and become entitled to pay resident fees. Moreover any student who has originally paid non-resident fees may become entitled to pay resident fees, if after an interim of nonattendance or otherwise he has established a valid legal domicile in this State at least twelve months prior to his registration in the University. In any event, the appointment of a guardian for a minor student temporarily resident in West Virginia, other than the designation of a natural guardian, shall not in and of itself operate to establish a West Virginia domicile for such student.

⁹The minimum rate for non-credit courses is that charged for one semester hour of credit.

¹⁰Athletics Fee, Student Educational Service Fee, Health and Counseling Services Fee, and University Fee non-refundable during this period. Student Union Fee and Daily Athenaeum Fee non-refundable unless the student withdraws officially before the close of General Registration.

50% of Athletics Fee, Student Educational Services Fee, Health and Counseling Services Fee, and University Fee, all chargeable to Special Services; and all other semester fees less \$2.50. (Under no circumstances is the amount retained less than \$2.50).

50% of Athletics Fee, Student Educational Services Fee, Health and Counseling Services Fee, and University Fee, all chargeable to Special Services; and 80% of all other semester fees.

60% of semester fees not chargeable to Special Services.¹⁰

40% of semester fees not chargeable to Special Services.¹⁰

The second Saturday following the beginning of general registration for a semester is the end of the first refund period. The second Saturday following the beginning of general registration for a summer session is the end of the refund period.

General Registration for full-time students for the First Semester is considered to be the first two days of the semester; for the Second Semester, the first two days of the semester; and for the Summer Session, the first day of the session.

General Registration for part-time students for the First and Second Semesters is considered to extend until the close of office hours on the second Saturday following the beginning of registration and for the Summer Session until the close of the eighth day of the session.

The University Board of Governors has ordered that students called to the armed services of the United States be granted full refund of refundable fees, but no credit, if the call comes before the end of the first three-fourths of the term, and that full credit by courses be granted to men called to the armed services of the United States if the call comes thereafter; provided, however, that credit as described above will be granted only in those courses in which the student is maintaining a passing mark at the time of his departure for military service. In the recording of final grades, for three-fourths of a term or more, both passing and failing grades are to be shown on the student's permanent record card.

Part IV

COURSES OF STUDY

ABBREVIATIONS

I—a course given in the first semester.
II—a course given in the second semester.
I, II—a semester course given in each semester.
I and II—a course given throughout the year.
S—a course given in the Summer Session.
hr.—number of credit hours per course.
rec.—recitation period.
lab.—laboratory period.
conc.—concurrent registration required.
PR.—prerequisite.
consent—consent of instructor required.

NOTE: Summer courses carry the same credit value as courses offered in the regular semesters.

PLAN FOR NUMBERING COURSES

Courses 200 to 299—Course open to graduate and upper-division undergraduate students.

Courses 300 to 399—Courses open to graduate students only.

AGRICULTURE AND FORESTRY

AGRICULTURE

THE DEGREE OF MASTER OF AGRICULTURE

Requirements: In general, the requirements for and the regulations governing the granting of this degree are the same as those for the Master of Science. A minimum total number of 30 credit hours, including the three for the problem report, is required. Specific requirements for the degree of Master of Agriculture are:

1. Candidates for the degree of Master of Agriculture shall have previously completed requirements for the degree of Bachelor of Science in Agriculture or its equivalent.

2. A problem report (rather than a research thesis) on some phase of agriculture shall be required. A maximum of 3 semester hours of credit may be allowed for the problem report, which must be approved by the student's committee. The candidate must submit an outline for his problem report to his committee prior to the completion of the first 12 hours of credit applicable to this degree.

3. The program of work shall be such that emphasis will be on breadth of knowledge in the field of agriculture rather than upon one narrow field of science. To insure such breadth of training, the student must take at least three credit hours of work in at least four subject-matter groups within the Division of Agriculture. A maximum of 12 credit hours, exclusive of the problem report, will be accepted in any subject-matter group or administrative department. The subject-matter groups from which the student may select courses are:

1. Agricultural Economics, Agricultural Education
2. Agricultural Mechanics
3. Animal Science
4. Bacteriology, Entomology
5. Agricultural Biochemistry, Genetics
6. Food Science
7. Landscape Architecture

8. Plant Sciences (Agronomy, Horticulture, and Plant Pathology)

9. Soil Science

A maximum of 10 credit hours taken in other divisions of the College of Agriculture and Forestry or in other colleges of the university may apply toward meeting the total credit-hour requirement.

AGRICULTURE

360. PROBLEM REPORT FOR THE DEGREE OF MASTER OF AGRICULTURE. I, II, S. 1-3 hr.

AGRICULTURAL BIOCHEMISTRY*

Work for the degree of Master of Science consists chiefly of course offerings selected according to the special needs of the students from 200 and 300 courses in the basic and biological sciences. A total of no fewer than 30 hours of graduate credit is required of which no more than 6 may be for thesis or research. A thesis is required.

Candidates for the Master of Science degree with a major in Agricultural Biochemistry should have training in general chemistry, analytical chemistry, organic chemistry, physical chemistry, and biochemistry. All beginning graduate students who expect to become candidates for an advanced degree must take examination in the above fields of chemistry during the week preceding their first registration. Deficiencies demonstrated by these examinations are to be removed by satisfactory completion of an approved course in that subject-matter area.

THE DEGREE OF DOCTOR OF PHILOSOPHY

Applicants for the degree of Doctor of Philosophy must have an M.S. or M.A. degree and pass comprehensive written and oral examinations in biochemistry and one or two minor fields. The applicant does not become a candidate for the degree until he has successfully passed the language examinations and the comprehensive examinations. These examinations must be passed one academic year before the degree is conferred.

OPPORTUNITIES FOR RESEARCH

An active research program is in operation in the department. Problems in the fields of nutrition, proteins, the chemistry of microorganisms, and carbohydrates are currently being investigated. The laboratories are well equipped and adequate to accommodate additional graduate students. Several graduate assistantships are available each year.

AGRICULTURAL BIOCHEMISTRY

- 202. INTRODUCTORY BIOCHEMISTRY. II. 3 hr. PR: Organic Chem. An introductory course of the biochemistry of carbohydrates, proteins, lipids, vitamins, enzymes, minerals and hormones of plants and animals.
- 203. INTRODUCTORY BIOCHEMISTRY LAB. II. 1 hr. PR: Agr. Biochem. 202, General chemistry, Organic chemistry. Biochemistry experiments to demonstrate certain phases of the subject matter covered in Agr. Biochem. 202. Also, the use of modern instruments for biochemistry will be taught.
- 214. RADIONUCLIDE BIOCHEMISTRY. I. 3 hr. PR: Chem. 1, 2, 131, or consent. Radionuclide methods and isotope handling as needed by students interested in biological research. Offered in Fall of even years.
- 290. GENERAL BIOCHEMISTRY. I. 3 hr. PR: Chem. 238, quantitative analysis and consent. A general course in biochemistry primarily intended to meet the needs of graduate students.
- 291. GENERAL BIOCHEMISTRY. II. 3 hr. PR: Agr. Biochem. 290 or consent. A continuation of Agr. Biochem. 290.
- 293. LABORATORY EXPERIMENTS IN BIOCHEMISTRY. I. 2 hr. PR or conc: Agr. Biochem. 290. Experiments to demonstrate certain phases of the subject matter covered in General Biochemistry.

*See also the course offerings in medical biochemistry, chemistry, botany, and zoology.

301. **ENZYMES.** II. 3 hr. PR: Agr. Biochem. 290 or consent. A general survey of the chemistry enzymes for the advanced student. Offered in Spring of odd years.

303. **BIOCHEMISTRY OF CARBOHYDRATES.** II. 2 hr. PR: Agr. Biochem. 291. The structure, properties and metabolism of sugars and polysaccharides. Offered in Spring of even years.

305. **LIPID BIOCHEMISTRY.** I. 3 hr. PR: Agr. Biochem. 290, 291, and consent. A consideration of the chemical and physical properties of the various classes of lipids and their biochemical and physiological pathways within the cell and cellular particulates.

308. **VITAMINS.** I. 2 hr. PR: Biochem. 101, 290, and 291 or consent. Identification, nomenclature and chemical structures, biochemical systems, biogenesis, pathology and requirements of vitamins and vitamin like compounds. Offered in Fall of odd years.

320. **SPECIAL TOPICS.** I, II, S. 2-4 hr. Advanced training will be provided through literature surveys and special research projects, in such areas as biochemical techniques, animal nutrition and metabolism.

330. **MINERAL METABOLISM.** I. 3 hr. PR: Chem. 1, 2, 31; Biochem. 290-291, or consent. The inorganic and biochemistry of the minerals in the body and the physiological function of minerals are studied. A special term paper is required of each student on the chemical metabolism studies. Offered in Fall of even years.

350. **SEMINAR.** I, II. 1 hr. per sem.

397. **RESEARCH.** I, II, S. 1-15 hr. per sem.

NOTE: Students assigned to a 200 course for graduate credit will be required to prepare a semester paper on some special phase of the course in addition to the regular course work.

AGRICULTURAL ECONOMICS

The Department offers major work for the degree of Master of Science in Agricultural Economics. Economics and Agricultural Economics faculties cooperate in offering a Ph.D. Degree. For details on this degree, see the College of Commerce section. Students are urged to seek approval from the Department Admissions Committee of one of the options listed below at the time they begin work. In all cases, approval must be obtained before completion of 18 hours of course work. Students expecting to become professional agricultural economists should seek approval of Option A. Those intending to pursue careers in agricultural business may wish to seek approval of Option B.

REQUIREMENTS FOR ADMISSION

Students may be accepted for graduate study in Agricultural Economics on a regular or probationary basis. Students meeting all of the following requirements are admitted as regular students:

1. A bachelor's degree.
2. Twelve or more semester credits in economics, agricultural economics, statistics, or appropriate social science courses.
3. A grade-point average of 2.5 for all college or university credit and for all credit in economics and agricultural economics. (Grade-point average is based on A=4.0.)

Students not meeting the above minimum requirements may petition for admission on a probationary basis. The Department Admissions Committee will set requirements for removing probationary status in each case. Failure of a student to fulfill the terms of his probation shall result in automatic suspension.

Students requesting transfer of graduate credit from courses outside the Department must obtain approval of the Department Admissions Committee for such transfer and the average for such courses transferred must be no less than 2.5. Such petitions must include all courses appropriate to the degree; courses with low grades will not be omitted.

OPTIONS OF STUDY

A. Thesis Option—A minimum of 30 credit hours of approved work to include not more than 6 hours of credit for the thesis, and enough courses to provide proficiency in economics and agricultural economics. Courses in closely related social sciences may be included.

B. Course-Work Option—A minimum of 36 credit hours of approved course work to provide proficiency in economics and agricultural economics. Courses in closely related social sciences may be included.

STANDARDS OF ACHIEVEMENT

A minimum grade-point average of 3.0 is required for all graduate credit courses taken as part of the approved program for this degree. This includes graduate credit transferred from within the University and graduate credit accumulated while pursuing a degree in Agricultural Economics.

Students who have earned a grade-point average of 2.75 or more with 12 or more hours of graduate credit will be admitted to candidacy. Those who do not attain this level will be placed on probation.

EXAMINATIONS

Thesis Option. Satisfactory completion of an oral examination and, at the discretion of the student's graduate committee, a written examination.

Course-Work Option. Satisfactory completion of a written and an oral examination.

AGRICULTURAL ECONOMICS

200. LAND ECONOMICS. II. 3 hr. PR: Econ. 52 or equiv. Classification, development, tenure, use, conservation, valuation and taxation, of rural, urban, mineral, forest, water, and recreational land resources.
206. FARM PLANNING. I. 3 hr. PR: Econ. 52 or equiv. Principal factors influencing returns on farms; planning use of labor, soil, crops, livestock, buildings and equipment. Farm visits required.
213. ECONOMIC DEVELOPMENT. I or II. 3 hr. PR: See College of Commerce listing. A comprehensive study of the problems, changes and principal policy issues faced by non-industrialized countries in the process of economic development. This is a dual listing with Economics 213. Students who elect this listing may not receive additional credit for Economics 213.
230. COOPERATIVE ORGANIZATION. II. 2-3 hr. PR: Econ. 52 or equiv. Organization, functions, and contributions of cooperatives in an economic system. Offered in Spring of even years.
235. MARKETING DAIRY PRODUCTS. II. 2 hr. PR: Econ. 52 or equiv. Milk marketing policies and practices, including milk-market orders. Offered in Spring of odd years.
240. AGRICULTURAL PRICES. II. 3 hr. PR: Econ. 52 or equiv. An analysis of the price-making forces which operate in the market places for the major agricultural commodities.
255. RESOURCE ANALYSIS IN AGRIBUSINESS AND FORESTRY. I. 3 hr. PR: Senior standing and Econ. 52 or equiv. Construction of models consistent with economic reality with specific processes and resource restrictions to solve problems in farm planning, forestry, animal industries and non-farm business using the digital computer and techniques of linear and dynamic programming.
261. AGRIBUSINESS FINANCE. I. 3 hr. PR: Econ. 52 or equiv. Credit needs of agricultural businesses; financing farm and market-agency firms; and organization and operation of credit agencies which finance agricultural business firms. Offered in Fall of odd years.
271. AGRICULTURAL POLICY. II. 3 hr. PR: Econ. 52 or equiv. An examination of the economic aspects of government price program, production and marketing

controls, subsidies, parity, export and import policies, and other programs affecting agriculture. Offered in Spring of even years.

- 320. SPECIAL TOPICS. I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
- 340. ADVANCED FARM MANAGEMENT. I. 3 hr. PR: Agr. Econ. 206. Offered in Fall of odd years.
- 341. PRODUCTION ECONOMICS. II. 3 hr. PR: Consent. Economic principles of production with special application to agriculture. Offered in Spring of odd years.
- 342. ADVANCED AGRICULTURAL ECONOMICS. II. 3 hr. PR: Econ. 52 or equiv.
- 397. RESEARCH. I and II. 1-15 hr. per sem.

AGRICULTURAL EDUCATION

Candidates for the Master of Science degree with a major in Agricultural Education must have done satisfactory work as undergraduates. The student's candidacy must be approved by the chairman of the department. Candidates for the master's degree in agricultural education must have fulfilled the requirements for B.S. Agr. at West Virginia University or at an approved institution offering an equivalent degree. Also, the candidate must have completed a minimum of 20 hours in education and 45 hours in agriculture.

Students shall combine graduate courses in agriculture and in education by taking 16 to 20 hours in agriculture and 10 to 14 hours in education. A minimum of 5 hours shall be in professional courses dealing with agricultural education. All graduate courses offered toward a degree must have prior approval of the adviser. The student and the adviser shall arrange a specific curriculum to be pursued for the degree at the beginning of the graduate program. A thesis or problem is required as a part of the 30 hours for graduation.

Students shall complete in residence 15 hours of course work after having completed one or more years of teaching vocational agriculture. This shall apply unless the student has been granted permission by the Department to complete his graduate work without teaching experience.

EDUCATION

- ED. 276. TEACHING YOUNG, ADULT FARMER AND OFF-FARM AGRICULTURAL OCCUPATIONS CLASSES. I, S. 2 hr. PR: Ed. 105, 106, or consent. Participation in conducting young, adult farmer, and off-farm agricultural occupations classes and school-community food preservation center; organization, course of study, method of teaching and supervision of the classes, young farmers' associations, adult farmers' organizations in classes.
- ED. 277. ORGANIZING AND DIRECTING SUPERVISED FARMING AND SUPERVISED OCCUPATIONAL EXPERIENCE PROGRAMS. I. S. 2 hr. PR: Ed. 160 or consent. Planning programs of supervised farming and supervised occupational experience, supervising and evaluating such programs for day students, young, adult farmer, and off-farm agricultural occupations classes and groups.
- ED. 318. PLANNING PROGRAMS AND COURSES FOR VOCATIONAL AGRICULTURE DEPARTMENTS. S. 2 hr. PR: Ed: 124, 160. Gathering data, studying the farming and off-farm agricultural occupations problems of day students, young farmers, adult farmers, and off-farm agricultural occupations groups and formulating total programs for school communities.

AGRICULTURAL EDUCATION

- 234. PRINCIPLES OF COOPERATIVE EXTENSION. I. 2 hr. Background philosophy, and history of cooperative extension. Activities of county cooperative extension agents and cooperative extension programs in West Virginia.
- 238. METHOD AND MATERIALS IN EXTENSION EDUCATION. II. 2 hr. Organization and preparation for extension teaching and the processes of communication.

239. **PROGRAM BUILDING IN COOPERATIVE EXTENSION.** II. 3 hr. PR: Agr. Educ. 234, 238, or consent. Organization in relation to program building. Leadership and group action. Overall working and educational objectives, principles, method, and goals in developing cooperative extension programs.

320. **SPECIAL TOPICS.** I, II, S. 1-4 hr. (For the Master's Degree, Special Topics ordinarily may count for 2 to 4 hr.; maximum credit, 6 hr.).

350. **SEMINAR.** I, II, S. 1 hr.

360. **PROBLEM.** I, II, S. 1-3 hr. (For the Master's Degree).

397. **RESEARCH.** I and II. S. 1-15 hr.

AGRICULTURAL AND FOREST ENGINEERING

See pages 145-147 for graduate programs in Agricultural Engineering and Forest Engineering.

AGRICULTURAL MECHANICS

Graduate study in Agricultural Mechanics is offered as a minor for Master of Science candidates majoring in other fields and to candidates seeking the Master of Agriculture Degree.

AGRICULTURAL MECHANICS

252. **ADVANCED FARM MECHANICS.** II. 3 hr. PR: Agr. Mech. 152. Forging, cold-iron work, tool fitting, woodworking. Offers training for teaching shop work in rural high schools. 1 hr. rec., 6 hr. lab.

253. **ADVANCED FARM MACHINERY.** II. 3 hr. Performance of agricultural equipment including calibration, efficiency, adjustments, and maintenance. Theoretical and practical aspects of selection based on economics, compatibility of machines with other equipment and the farming operation, service, and factors of custom operation. 2 hr. rec., 3 hr. lab.

259. **FARM STRUCTURES.** II. 3 hr. Fundamentals of construction, functional requirements, materials, new equipment, and use of laborsaving ideas and machinery. 2 hr. rec., 3 hr. lab.

270. **ELECTRICITY IN AGRICULTURE.** II. 3 hr. The study of the fundamentals of electrical energy and its application to lighting power, heating, and control circuits used in agriculture. 2 hr. rec., 3 hr. lab.

275. **AGRICULTURAL ENGINES.** I. 3 hr. Relation of theory to design and operation of internal combustion engines with emphasis on care, operation, and maintenance. Study covers one, two, three, four, six, and eight cylinder engines, both in two and four stroke designs. 2 hr. rec., 3 hr. lab.

320. **SPECIAL TOPICS.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).

397. **RESEARCH.** I and II, S. 1-15 hr.

AGRONOMY AND GENETICS

The Department of Agronomy and Genetics offers the degrees of Master of Science and Doctor of Philosophy with majors in crops, soils, and genetics.

Adequately equipped laboratories, greenhouse, and growth chambers are available. Several experimental farms are available for field investigations.

To enter graduate work, the student must have adequate background in the physical and biological sciences in addition to basic courses in crop science, genetics, or soil science. Students who have not had these basic courses will be required to take them without credit early in their graduate program. In addition to courses in their major field of study, students will be expected to study in one or more related fields with the course selection dependent upon the field of interest.

The course schedule for graduate study will be developed in consultation with the student's adviser and will include certain designated requirements for each curriculum.

A thesis or problem report and a final examination are required for the Master of Science degree. Requirements for the Doctor of Philosophy degree are as outlined by the Graduate School.

AGRONOMY (CROP SCIENCE)

250. TURFGRASS MANAGEMENT. I. 3 hr. PR: Agron. 2, or consent. The establishment, maintenance, and adaptation of grasses and legumes for lawns, golf courses, parks, athletic fields and roadsides. An understanding of turfgrass management will be developed by associating differential plant responses with soil, climatic, and biotic factors that influence plant species growth, selection, and adaptation. Offered in Fall of even years.
251. WEED CONTROL. I. 3 hr. PR: Agr. 52 and Agron. 2 or consent. Fundamental principles of weed control. Recommended control measures for and identification of common weeds. 2 lec., 1 lab. Offered in Fall of odd years.
252. GRAIN AND SPECIAL CROPS. II. 3 hr. PR: Agr. 52 and Agron. 2 or consent. Advanced study of methods in the production of grain and special crops. Varieties, improvement, tillage, harvesting, storage, and uses of crops grown for seed, or special purposes. Offered in Fall of even years.
254. PASTURE AND FORAGE CROPS. II. 4 hr. PR: Agr. 52 and Agron. 2 or consent. All phases of pasture and forage crop production, including identification, seeding, management, use, seed production, and storage of forage crops. 3 lec., 1 lab. Offered in Spring of even years.

AGRONOMY (SOIL SCIENCE)

210. SOIL FERTILITY. I. 3 hr. PR: Agron. 2 or 10. Soil properties in relation to fertility and productivity of soils; evaluation of soil fertility; production of fertilizers and their use in increasing the fertility and productivity of soils.
212. SOIL CONSERVATION AND MANAGEMENT. II. 3 hr. PR: Agron. 2 or 10. Using soil technology to solve soil management problems relating to cropping systems. Field diagnosis of soil problems will be stressed. Two half-day visits. Offered in Spring of odd years.
216. SOIL GENESIS AND CLASSIFICATION. II. 3 hr. PR: Agron. 2 or 10. Origin and formation of soils. Study of soil profiles and soil forming processes in the field and laboratory. Principles of classification and techniques of soil mapping. 2 lec., 1 lab. Offered in Spring of even years.
230. SOIL PHYSICS. I. 3 hr. PR: Agron. 2 or 10. Physical properties of soils, water and air relationships and their influence on soil productivity. Offered in Fall of odd years. 2 lec., 1 lab.
301. GEOTECHNIC. I. 3 hr. PR: Consent. A presentation of a unified approach to the various aspects of soil formation and the influence of the formative factors on the nature of soils and their use as engineering materials. This course will serve as a common meeting ground for students in the various disciplines concerned with the earth sciences. 3 lec. Offered in the Fall of odd years.
316. SOIL CHEMISTRY. I. 3 hr. PR: Consent. Fundamental chemical properties of soils in relation to plant growth; nature and properties of soil colloids; base exchange and soil acidity; availability of plant food elements and soil-plant interrelationships. Offered in Fall of odd years.

AGRONOMY (CROP AND SOIL SCIENCE)

320. SPECIAL TOPICS. I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
350. SEMINAR. I, II. 1 hr. per sem. Recent literature pertaining to soil and crop production.
397. RESEARCH. I, II. 1-15 hr. per sem.

GENETICS

220. CROP BREEDING. II. 3 hr. PR: Gen. 171 or 221. Methods and basic scientific principles involved in the improvement of leading cereal and forage crops through hybridization and selections. Offered in Spring of odd years.

221. BASIC CONCEPTS OF MODERN GENETICS. I. 3 hr. PR: 8 hr. of biological science and 1 year of chemistry. Independent inheritance, linkage. Chemical nature of genetic material. Control of phenotype by genetic material. Gene action and coding of genetic material.

224. HUMAN GENETICS. II. 3 hr. PR: Gen. 171 or 221 or consent. A study of the genetic system responsible for the development of phenotype in man. Offered in Spring of even years.

320. SPECIAL TOPICS. I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.: maximum credit, 6 hr.).

324. CYTOGENETICS. II. 4 hr. PR: Gen. 171 or 221, and Biol. 152 or 221, or consent. Emphasis is put upon macromolecules that carry information of the chromosomes, cell division and the cytological and molecular basis of genetics. Special attention is given to cytogenetics of genomes and chromosome morphology and the evolution of these. Offered in Spring of odd years.

326. ADVANCED PHYSIOLOGICAL GENETICS. II. 3 hr. PR: Gen. 171 or 211 and Organic Chem. Physiological and biophysical concepts of genetic material. Structure and arrangement of genetic units. Nucleic acids as carriers of genetic information. Gene action and amino acid coding. Biochemical evolution of genetic material. Offered in Spring of even years.

335. POPULATION GENETICS. I. 3 hr. PR: Gen. 171 or 221, or consent. The relationship of gene and genotype frequencies in populations of diploid organisms, and the effects of mutation, migration, selection, assortive mating, and inbreeding, in relation to single gene pairs. Application of these concepts to the multigenic inheritance of quantitative traits. Offered in Fall of even years.

350. SEMINAR. I, II. 1 hr. per sem. Recent literature pertaining to breeding, genetics, and cytology.

397. RESEARCH. I, II. 1-15 hr. per sem.

BACTERIOLOGY

314. SOIL MICROBIOLOGY. II. 4 hr. PR: Bact. 141 and organic chemistry. Occurrence and distribution of microorganisms in soils and their interrelationships. Their role in decomposition of organic matter and other transformations of soil constituents. Offered in Spring of odd years.

ANIMAL INDUSTRY AND VETERINARY SCIENCE

The Department of Animal Industry and Veterinary Science offers a Master of Science program in Animal Breeding, Animal Nutrition, Animal Physiology, Food Science, and Animal Production (Dairy, Livestock and Poultry), Doctor of Philosophy programs in Animal Nutrition and in Reproductive Physiology.

To enter graduate work the student should have basic courses in the physical and biological sciences in addition to a basic course in Breeding, Nutrition, Physiology and Pathology. Students who have not had such courses will be required to take these early in their graduate work. Twenty-four approved credits and a thesis are required for the Master's degree.

The doctorate programs are governed by the general regulations of the Graduate School.

ANIMAL INDUSTRY AND VETERINARY SCIENCE

320. SPECIAL TOPICS. I, II, S. 1-4 hr. (1 hr. credit in special cases only). Advanced study in particular phases of such animal industry topics as animal production, nutrition, physiology, breeding and genetics, veterinary science, and food science. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).

370. METHODS OF ANIMAL RESEARCH. I. 3 hr. Design, experimental procedures, and analyses used in research in the several areas of animal industry. Offered in Fall of odd years.

ANIMAL BREEDING AND GENETICS

212. POULTRY BREEDING. I. 3 hr. PR: Course in Genetics or consent. Breeding techniques specific for genetic improvement of economic traits in poultry.

226. BREEDING OF FARM ANIMALS. II. 3 hr. PR: Course in Genetics or consent. Application of principles of quantitative population genetics to the improvement of farm animals.

326. ADVANCED ANIMAL SELECTION. II. 3 hr. PR: Course in Statistics and course in Genetics or equiv. An advanced course dealing with the basic concepts of experimental and statistical approaches in the analysis of quantitative inheritance with special reference to the magnitude and nature of genotypic and non-genotypic variability. Offered in Spring of even years.

350. SEMINAR. I, II. 1 hr. per sem.

397. RESEARCH. I, II. 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

ANIMAL NUTRITION

294. POULTRY NUTRITION. II. 3 hr. PR: An. Nutr. 101. Nutritional requirements, nutrient interrelationships and nutritional deficiencies of all types of domesticated fowl.

295. PRINCIPLES OF NUTRITION AND METABOLISM. I. 3 hr. PR: Agr. Biochem. 201, An. Physiol. 100, or equiv. A basic course in animal nutrition.

305. COMPARATIVE NUTRITION AND METABOLISM. II. 3 hr. PR: An. Nutr. 295 or consent. A comparative study of the utilization of dietary nutrients by species of laboratory and domestic animals and man. Offered in Spring of odd years.

306. NUTRITION LABORATORY METHODS. I. 2 hr. PR: An. Nutr. 295 or concurrent registration, Agr. Biochem. 203. Chemical, physical, and biological methods used in animal nutrition research. Offered in Fall of odd years.

307. NUTRITION LABORATORY METHODS: ANIMAL TECHNIQUES. II. 2 hr. Laboratory experiments in sampling, digestibility determinations, equalized intake anti-coprophagy devices, balance studies, bioassay and experimental surgery. Offered in Spring of odd years.

308. ADVANCED NUTRITION AND METABOLISM. II. 3 hr. PR: An. Nutr. 305 or consent. Advanced treatment of the nutrition, metabolism, nutrient interrelationship and metabolic regulatory mechanisms of domestic animals. Offered in Spring of odd years.

310. NUTRITION AND PHYSIOLOGY OF THE RUMINANT. II. 3 hr. PR: Physiol. 100; An. Nutr. 101; Agr. Biochem. 290. A study of the nutrition and physiological processes peculiar to the ruminant animal. Offered in Spring of even years.

311. PROBLEMS IN NUTRITIONAL PHYSIOLOGY. I. 3 hr. PR: An. Nutr. 305 or consent. Consideration of the interrelation of nutrition with growth, reproduction, environment, disease and related areas. Offered in Fall of odd years.

350. SEMINAR. I, II. 1 hr.

397. RESEARCH. I, II, S. 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

ANIMAL PHYSIOLOGY

204. ANIMAL PHYSIOLOGY LABORATORY. 2 hr. PR: An. Physiol. 100 or concurrent registration. Laboratory study of the physiological systems of animals and the influences of environment on these systems.

225. PHYSIOLOGY OF REPRODUCTION. II. 3 hr. PR: Zool. 2 or consent. Comparative physiology of reproduction in higher animals, endocrine functions involved in reproduction, genetic and environmental variations in fertility mechanisms.

227. MILK SECRETION. II. 3 hr. (1 lab.). PR: Chem. 131; An. Physiol. 225. The evolution, anatomy, and growth of the mammary gland. The chemical, hormonal, physiological and environmental factors affecting lactation. Offered in Spring of odd years.

235. COMPARATIVE ENDOCRINOLOGY OF REPRODUCTION. 2 hr. (1 lab.). PR: An. Physiol. 225 or Zool. 272 (conc.), or consent. Laboratory experience in classical reproductive endocrinology and current concepts of hormonal regulation with emphasis on species differences and similarities.

280. BEHAVIORAL PATTERNS OF DOMESTIC ANIMALS. II. 3 hr. Examination of the bases for, and exhibition and control of behavioral patterns of domestic animals.

350. SEMINAR. I, II. 1 hr.

397. RESEARCH. I, II. 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

NOTE: Students are also referred to Psych. 201, Physiological Psychology; Zool. 171, Human Physiology; Zool. 273, 274, Cellular Physiology; and Zool. 276, Comparative Physiology.

ANIMAL PRODUCTION

201. ADVANCED POULTRY PRODUCTION. I. 3 hr. PR: Course in Nutrition. Special phases of broiler and egg production, disease control, laborsaving studies, recent designs in building and heating equipment for all types of poultry. Offered in Fall of even years.

223. ANIMAL PRODUCTION. II. 3 hr. (1 lab.). PR: An. Nutr. 101. Application of breeding, physiology, and nutrition to problems in meat animal production.

224. CURRENT LITERATURE IN ANIMAL SCIENCE. II. 3 hr. (1 lab.). PR: An. Nutr. 101. Evaluation of current research in animal science and its application to production and management.

330. ADVANCED MILK PRODUCTION. II. 3 hr. PR: An Nutr. 101 or consent. Advanced study of the feeding, breeding, and management of dairy cattle. Offered in Spring of odd years.

350. SEMINAR. I, II. 1 hr.

397. RESEARCH. I, II. 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

FOOD SCIENCE

*202. ADVANCED MEATS. II. 3 hr. (2 labs.). PR: Food Sci. 167. Studies covering composition of meat, complete fabrication of meat animal carcasses, factors influencing yield, physiology and chemistry of pertinent phenomena, and merchandising of meat. Offered in Spring of even years.

232. ADVANCED DAIRY TECHNOLOGY. II. 4 hr. (2 labs.). Study of the effect of major milk constituents on properties of dairy products and study of analytical methods used in quality and composition control of dairy products. Offered in Spring of odd years.

312. CRITICAL EVALUATION OF RECENT RESEARCH AND DEVELOPMENTS IN DAIRY FOODS. I. 4 hr. (2 labs.). PR: Consent. Normally a minimum of Bact. 246 and at least one Dairy Foods course will be required. Methods, results and impact of recent research and developments pertaining to dairy food industry. Offered in Fall of even years.

*Transportation for required trips in connection with these courses will generally be supplied by the College. Students will be responsible for their meals and lodging.

350. SEMINAR. I, II. 1 hr.

397. RESEARCH. I, II. 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

VETERINARY SCIENCE

205. PARASITES AND PATHOLOGY. II. 3 hr. PR: Zool. 2 or equiv. Common parasites of farm animals, their control, and their effect upon the host. Offered in Spring of odd years.

210. PRINCIPLES OF LABORATORY ANIMAL SCIENCE. 3 hr. (1 lab.). PR: Consent for undergraduates. The management, genetics, physiology, nutrition, disease, and germ free methods of the common laboratory animals.

350. SEMINAR. I, II. 1 hr.

397. RESEARCH. I, II. 1-15 hr. per sem. For graduate students working on a problem in preparation of a thesis.

HORTICULTURE

The candidate for the degree of Master of Science should offer a minimum of 30 semester hours properly distributed among the related sciences and his major field.

Departments offering graduate courses of special interest and value to students of horticulture are: botany, chemistry, genetics, soils, plant pathology, economics, education, and entomology. A thesis is required.

HORTICULTURE

204. PLANT PROPAGATION. II. 3 hr. A study of the practices of plant propagation and the factors involved in reproduction in plants.

229. LANDSCAPE DESIGN. I. 3 hr. (1 lec., 1 scheduled lab., 1 arranged lab.). A course in ornamental horticulture giving an appreciation of the basic principles of design and information pertaining to the use and care of ornamental plants around the home.

242. SMALL-FRUIT. I. 3 hr. (2 lec., 1 scheduled lab.). The taxonomic, physiological, and ecological principles involved in the production and handling of small-fruits.

243. PHYSIOLOGY OF VEGETABLES. I. 3 hr. (2 lec., 1 scheduled lab.). Physiological and ecological principles involved in the production of vegetable crops.

244. HANDLING AND STORAGE OF HORTICULTURAL CROPS. II. 3 hr. (2 lec., 1 scheduled lab.). Characteristics of perishable crops. Methods and materials employed to maintain quality.

301. POST-HARVEST PHYSIOLOGY. II. 3 hr. (1 lec., 2 labs.). Physiology and biochemistry of harvested crops.

320. SPECIAL TOPICS. I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).

350. SEMINAR. I, II. 1 hr. (1 seminar). Recent literature in the plant sciences which pertains to horticultural science.

397. RESEARCH. I, II, S. 1-15 hr. per sem.

PLANT PATHOLOGY, BACTERIOLOGY, AND ENTOMOLOGY

Candidacy. Graduate students in Plant Pathology, Bacteriology, or Entomology must hold a Bachelor's Degree from an approved college. To enter into graduate work without condition in these fields the student must have an *adequate background of approved courses in biology or agriculture*. Additional undergraduate work in chemistry, physics, mathematics, or botany may be required according to the needs

of the field of specialization followed by the student. Admission to candidacy is conditioned upon a suitable period in residence and a demonstrated ability to do work of graduate caliber.

Course Requirements. A candidate for the Master's Degree in Plant Pathology, Bacteriology, or Entomology must pass satisfactorily 30 credits of approved work of which 6 may be for a thesis. A thesis is required.

The doctorate is offered only in Plant Pathology and Agricultural Microbiology and candidates for these degrees are governed by the general regulations of the Graduate School.

AGRICULTURAL BACTERIOLOGY

- 247. **Food Microbiology.** I. 4 hr. PR: Bact. 141, organic chemistry or consent. The ecology and physiology of microorganisms important in the manufacture and deterioration of foods, and the techniques for the microbiological examination of foods. Offered in Fall of even years.
- 248. **Sanitary Bacteriology.** I. 3 hr. PR: Bact. 141. Standard bacteriological methods used in routine examination of water sewage. Offered in Fall of odd years.
- 314. **Soil Microbiology.** II. 4 hr. PR: Bact. 141 and organic chemistry. Occurrence and distribution of microorganisms in soils and their interrelationships. Their role in decomposition of organic matter and other transformations of soil constituents. Offered in Spring of odd years.
- 320. **SPECIAL TOPICS.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
- 350. **SEMINAR.** I, II. 1 hr. per sem.
- 397. **RESEARCH.** I, II, S. 1-15 hr. per sem.

ENTOMOLOGY

- 202. **AGRICULTURAL ENTOMOLOGY.** II. 4 hr. PR: Zool. 1, 2. A course dealing with the basic aspects of insect life, emphasizing the study of economically important insects and their control. Designed to meet the needs of students in agriculture. Does not carry graduate credit for majors in Entomology.
- 313. **INSECT TRANSMISSION OF PLANT DISEASES.** I. 3 hr. PR: Pl. Path. 153, 201, or Entom. 202. Role of insects in spread and development of plant diseases. Offered in Fall of odd years.
- 320. **SPECIAL TOPICS.** I, II, S. 2-6 hr. PR: Entom. 202. Advanced study of entomological topics of special interest to the student.
- 350. **SEMINAR.** I, II. 1 hr. per sem.
- 397. **RESEARCH.** I, II, S. 1-15 hr. per sem.

PLANT PATHOLOGY

- 201. **GENERAL PLANT PATHOLOGY.** I. 4 hr PR: Bact. 141. Nature and causes of plant diseases; methods of control.
- 202. **PRINCIPLES OF PLANT PATHOLOGY.** II. 4 hr. PR: Bact. 141 and either Pl. Path. 152, 201, or 203, or consent. Primarily for graduate students and seniors majoring in botany, biology, or agricultural science. Nature of diseases in plants with practice in laboratory methods. Offered in Spring of even years.
- 203. **MYCOLOGY.** I. 4 hr. Lectures, field and laboratory studies of parasitic and saprophytic fungi.
- 209. **NEMATOLOGY.** I. 3 hr. PR: Pl. Path. 201 or consent. Primarily for graduate students majoring in the agricultural sciences, zoology, or botany. Nematode taxonomy, bionomics, and control, with particular emphasis on plant parasitic forms. Offered in Fall of even years.

301. DISEASES OF ECONOMIC PLANTS. I, II. 2-8 hr. PR: Pl. Path. 201 and 203, or consent. Important diseases of field, forage, fruit, vegetable, and ornamental plants; causes and controls. The course is divided into four sections; one section for 2 hours credit will be offered each semester. Students may register for this course each semester until accumulating credit of 8 hours.

313. INSECT TRANSMISSION OF PLANT DISEASES. I. 3 hr. PR: Pl. Path. 153, 201, or Entom. 202. Role of insects in spread and development of plant disease. Offered in Fall of odd years.

315. ADVANCED FOREST PATHOLOGY. II. 2 hr. PR: Pl. Path. 203 and either Pl. Path. 153 or Pl. Path. 201. Principles, substance, and application of our knowledge of tree diseases and decays, especially as they may be related to forest management practices. Offered in Spring of even years.

320. SPECIAL TOPICS. I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).

330. PHYSIOLOGY OF THE FUNGI. II. 4 hr. PR: Organic chem., mycology, and bact., or consent. Physiological aspects of growth, reproduction, and parasitism of fungi, with emphasis on nutrition, environment, and other biotic factors.

340. TAXONOMY OF THE FUNGI. S. 3 hr. PR: Pl. Path. 203. Collection and identification of fungi with emphasis upon those of economic importance. Offered in Summer of even years.

350. SEMINAR. I, II. 1 hr. per sem.

397. RESEARCH. I, II, S. 1-15 hr. per sem.

FORESTRY

THE DEGREE OF MASTER OF SCIENCE IN FORESTRY

Graduate students in Forestry must have completed a four-year forestry curriculum and hold a Bachelor's Degree from an approved college. Students may major in Forest Ecology, Forest Economics, Forest Genetics and Tree Improvement, Forest Management, Forest Mensuration, Silviculture, or Wood Industries.

A candidate for the Degree of Master of Science in Forestry must pass satisfactorily 30 credits of approved work, of which 6 may be for a thesis. A thesis is required.

THE DEGREE OF MASTER OF SCIENCE

This degree may be obtained in the field of wood science and technology and in wildlife management. Fulfillment of the general regulations for graduate degrees is required.

FOREST ENGINEERING

MASTER OF SCIENCE IN ENGINEERING

See page 146.

FORESTRY

213. FOREST GENETICS AND TREE IMPROVEMENT. I. 3 hr. PR: Genetics 171 or equiv., or consent. Forest genetic principles and their application to forest tree improvement including crossing methods, selection systems, and other tree improvement techniques.

214. ADVANCED PRINCIPLES OF FORESTRY ECONOMICS. I. 3 hr. PR: Econ. 51 and 52 or equiv.; For. 114 or equiv. Intensive study of both the micro- and macro-economics of forestry.

217. FOREST MANAGEMENT PLANS. II. 2 hr. PR: For 123. Analyses of forest management plans. Construction of a sustained yield timber management plan for a specific forest tract.

222. FOREST MENSURATION. II. 3 hr. PR: For. 21. The measurement of growth and yield; statistical methods applied to forest measurement problems.

225. WOOD FINISHING. I. 3 hr. PR: For. 130 or For. 131 or consent. A technical course in wood finishing covering surface preparation, composition of finishing materials, equipment, techniques, defects, trouble-shooting and quality control.

231. WOOD MICROSTRUCTURE. I. 3 hr. PR: For. 131, Senior standing, or consent. A detailed examination of wood microstructure as it relates to processing, behavior, and identification.

232. MECHANICAL PROPERTIES OF WOOD. I. 3 hr. PR: T.A.M. 102. Properties and behavior of wood as a structural material.

236. ADVANCED WOOD PROCESSES. I. 3 hr. PR: For. 136, Senior standing, or consent. Detailed study of the materials and processes involved in the manufacture of secondary wood products, using wood furniture as the primary example.

241. WILDLIFE TECHNIQUES. II. 3 hr. PR: For 141, 145, Bot. 161 or consent. Field and laboratory techniques necessary in the management and study of wildlife; collection of field data, mapping, censusing, habitat evaluation, literature and reports are stressed.

242. WILDLIFE POPULATION ECOLOGY. I. 3 hr. PR: For. 141 or equiv.; Stat. 211 or equiv. Theory of population growth, population change, intraspecific and and interspecific relationships that are involved in the natural regulation of populations, and the effects of man on populations of wild game.

311. ENVIRONMENTAL RELATIONSHIPS IN HARDWOOD FORESTS. I. 3 hr. PR: For. 112. The study of environmental factors affecting establishment, composition, and growth of hardwood forests.

312. SILVICULTURAL PRACTICES FOR HARDWOOD FOREST TYPES. II. 3 hr. PR: For. 112, 116. Designing proper silvicultural systems for managing Appalachian hardwood stands; reconstructing stand histories, recognizing problems, and prescribing appropriate silvicultural treatment.

315. ADVANCED FOREST REGULATION. I, II. 2 hr. PR: For. 123 or equiv. An intensive study of area and volume regulation suitable for applied forestry in the United States.

320, 321. SPECIAL TOPICS. I, II. 2-4 hr. per sem. PR: Consent. (For the Master of Science Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).

350. SEMINAR IN SILVICULTURE. I, II. 1 hr. per sem.; maximum credit, 4 hr. PR: Consent. Reports and discussions of recent research in fundamental and applied phases of silviculture with emphasis on hardwood forest types.

352. SEMINAR IN WOOD UTILIZATION. I, II. 1 hr. per sem.; maximum credit, 4 hr. PR: Consent. Reports and discussions of recent research in fundamental and applied phases of wood utilization.

354. WILDLIFE SEMINAR. II. 1 hr. per sem.; max. credit, 4 hr. PR: Consent. Discussion of current developments in wildlife management.

397. RESEARCH. I, II, S. 1-15 hr. per sem. PR: Consent. For graduate students working on a thesis problem.

ARTS AND SCIENCES

BIOLOGY

The Department of Biology offers work leading to the degrees of Master of Arts in Biology, Master of Science, and Doctor of Philosophy in either Botany or Zoology. The department has certain requirements in addition to those of the Graduate School. Current information concerning the graduate programs of the department should be acquired by writing the Chairman, Department of Biology, before seeking admission to the Graduate School. The enrollment of degree candidates is subject to the availability of satisfactory research space and facilities for thesis work. Students may enroll in graduate courses, but may work toward an advanced degree only with the approval of the department.

Applicants are expected to have a broad foundation of training in biology and in related sciences, particularly chemistry. Deficiencies in undergraduate training may prolong the required course program for advanced degrees.

Course offerings listed below are subject to change.

BIOLOGY

- 203. NATURAL HISTORY. S. 3 hr. PR: General biology or equiv. Lectures, demonstrations, and field trips designed to provide a brief survey of certain aspects of general biology suitable for elementary and high schools.
- 204. BIOLOGY WORKSHOP. S. 3 hr. PR: Biol. 2 or equiv. Lectures and demonstrations designed to aid the teacher of pre-college biology, and constituting a general review.
- 205. PRINCIPLES OF EVOLUTION. I. S. 3 hr. PR: Biol. 2. An introduction to the study of evolution.
- 206. MODERN CONCEPTS IN BIOLOGY. S. 2-3 hr. PR: Biol. 2 or equiv. A course designed to acquaint the advanced student or teacher with the latest methods and knowledge in the field of biology. The effect of new information in confirming or changing older concepts will be fully explored, with student participation emphasizing different areas.
- 207. HISTORY OF BIOLOGY. I. 3 hr. PR: Biol. 2. History of the development of biological knowledge, with philosophical and social backgrounds.
- 208. GREAT TEXTS OF BIOLOGY. II. 1 hr. PR: Biol. 2 or equiv. A study of some of the great classics in biology, such as Theophrastus' *Enquiry into Plants*, Vesalius' *Epitome*, Harvey's *Motion of the Heart and Blood*, Darwin's *Origin of Species*, and Mendel's *Experiments on Hybrid Plants*.
- 215. CYTOLOGY. II. 4 hr. PR: Biol. 2. Cells, their development and structure.
- 273, 274. CELLULAR AND MOLECULAR BIOLOGY. I, II. 4 hr. per sem. PR: Biol. 2, Chem. 238 and Physics 2. A consideration of the functions common to all forms of living matter.
- 296, 297. SPECIAL TOPICS. I, II. 1-4 hr. per sem. PR: Consent. Critical studies of topics to be assigned by the instructor.
- 321, 322. SEMINAR IN ECOLOGY. I, II. 2 hr. per sem. PR: Bot. 221, Zool. 224 or For. 242 and consent. Selected topics on relations of organisms to environment and on communities of organisms.
- 376, 377. SEMINAR IN PHYSIOLOGY. I, II. 2 hr. per sem. PR: Biol. 274, Bot. 273, Zool. 271, or Pl. Path. 330, and consent. Selected topics on functions common to all organisms.

BOTANY

- 201, 202. SEMINAR. I, II. 1 hr. Topics of general interest to botanists are considered.

218. ECONOMIC BOTANY. II. 3 hr. PR: Biol. 2. Plants from the standpoint of their value to man.

221. PLANT ECOLOGY. I. 4 hr. PR: Biol. 2 Environmental relationships of plants.

224. PLANT COMMUNITIES. S. 3 hr. PR: Biol: 2 or equiv. Field studies in ecology.

227. GEOGRAPHIC BOTANY. I, S. 2 or 3 hr. PR: Biol. 2. Study of plant groupings and worldwide distribution of plants.

231. PLANT MORPHOLOGY. I. 4 hr. PR: Biol. 2. Development and structure of algae and fungi.

232. PLANT MORPHOLOGY. II. 4 hr. PR: Biol. 2 or Bot. 2. Development and structure of bryophytes and vascular plants.

235. PLANT ANATOMY. I. 4 hr. PR: Biol. 2 or equiv. Anatomy of seed plants.

250. FRESH WATER ALGAE. I. 4 hr. PR: Biol. 1, 2. Taxonomy, cytology, and ecology of aquatic, aerial and land forms of fresh-water algae.

255. BRYOPHYTES. II. 2 hr. PR: Biol. 2. Identification of liverworts and mosses.

256. VASCULAR CRYPTOGAMS. II. 4 hr. PR: Biol. 1, 2. Taxonomy, anatomy, cytology, and ecology of the culb-mosses, horsetails, and ferns.

261. ADVANCED SYSTEMATIC BOTANY. I. 3 hr. PR: Bot. 161 or equiv. Taxonomy of pteridophytes, gymnosperms, and monocotyledons.

262. ADVANCED SYSTEMATIC BOTANY. II. 3 hr. PR: Bot. 161 or equiv. Taxonomy of pteridophytes, gymnosperms, and monocotyledons.

263. TAXONOMY OF VASCULAR PLANTS. S. 3 hr. PR: Biol. 2 or equiv. Field studies in the taxonomy of higher plants.

265. AQUATIC SEED PLANTS. I. 3 hr. PR: Biol. 2 or equiv. Classification, ecology, and economic importance of aquatic seed plants.

266. FLORA OF WEST VIRGINIA. II, S. 3 hr. PR: Biol. 2 or equiv. A consideration of the native plant life of the State.

296, 297. SPECIAL TOPICS. I, II. 1-4 hr. per sem. PR: Consent. Critical studies of topics to be assigned by the instructor.

316. CYTOTAXONOMY. II. 3 hr. PR: Biol. 2, Bot. 161, Genet. 221, or consent. The determination of phylogenetic relationships by cytological and taxonomic methods.

325. EXPERIMENTAL PLANT ECOLOGY. II. 2-4 hr. PR: Biol. 1, Bot. 161, and Bot. 221 or equiv. Advanced field studies in plant ecology.

331. PLANT EMBRYOLOGY. II. 2 hr. PR: Biol. 2 and consent. Gametogenesis, syngamy, and embryo development in vascular plants.

332. PLANT MORPHOGENESIS. II. 4 hr. PR: Organic Chem. or Biochem.; Pl. Anat. or Cytology, Pl. Phys. or Genetics. Experimental studies of plant growth and development.

351, 352. PROBLEMS IN PLANT TAXONOMY. I, II. 1-6 hr. PR: Bot. 261, 262, or equiv.

374. ADVANCED PLANT PHYSIOLOGY. II. 3 hr. PR: Bot. 171 or equiv.; also courses in general physics and organic chemistry. Advanced studies of plant processes including recent advances in the field.

397. RESEARCH. I, II, S. 1-15 hr.

ZOOLOGY

210. ANIMAL BEHAVIOR. I. 3 hr. PR: Biol. 2 or equiv. Principles of individual and group behavior.

222. FIELD STUDIES OF INVERTEBRATES. S. 3 hr. PR: Biol. 2 or equiv. Taxonomy and ecology of the invertebrates.

223. FIELD STUDIES OF VERTEBRATES. S. 3 hr. PR: Biol. 2 or equiv. Taxonomy and ecology of the vertebrates.

224. LIMNOLOGY. I. 4 hr. PR: Biol. 2 or equiv. Physical, chemical, and biological investigations of lakes and inland waters.

231. COMPARATIVE ANATOMY. I. 5 hr. PR: Biol. 2 or equiv. Organs and systems of various vertebrates, together with other facts of interest concerning these animals.

232. VERTEBRATE EMBRYOLOGY. II. 5 hr. PR: Biol. 2 or equiv. Introductory study of development of vertebrates, based on frogs, fowls, and mammals.

233. COMPARATIVE HISTOLOGY. II. 4 hr. PR: Zool. 231 and consent. Limited to seniors and graduate students. A comparative study of tissues of the vertebrates.

235. COMPARATIVE DEVELOPMENTAL ANATOMY. II. 3 hr. PR: Zool. 231. Anatomy and development of the organs and systems of various vertebrates.

236. COMPARATIVE NEUROANATOMY. II. 4 hr. PR: Zool. 231, and consent. Comparative study of development and anatomy of the nervous systems of the vertebrates.

237. OSTEOLOGY. I. 2 hr. PR: Biol. 2 or equiv. Development and anatomy of the skeleton.

251. INVERTEBRATE ZOOLOGY. I. 4 hr. PR: Biol. 2 or equiv. Advanced study of animals without backbones.

255. GENERAL PARASITOLOGY. I. 4 hr. PR: Upper division standing and consent. The biology of parasites.

263. ICHTHYOLOGY. I. 3 hr. PR: Biol. 2 or equiv. Ecology, life histories, taxonomy, and distribution of fishes.

264. FISHERIES BIOLOGY. II. 4 hr. PR: Biol. 2 or equiv. Principles and techniques of fisheries management with an introduction to the theory of population.

265. ORNITHOLOGY. II. 3 hr. PR: Biol. 2 or equiv.; consent. Field and laboratory studies on identification, migration, protection, nesting, and food habits of birds.

271. HUMAN PHYSIOLOGY. I, II, S. 4 hr. An introductory course in the functions of man.

272. PHYSIOLOGY OF THE ENDOCRINES. II. 4 hr. PR: General zoology or general biology, comparative anatomy, and organic chemistry. Comparative physiology and endocrine mechanisms. The relation of hormonal and parahormonal agents to chemical coordination, metabolism, growth, development, and sex.

275. VERTEBRATE PHYSIOLOGY. I. 4 hr. PR: Zool. 2 or equiv. The functions of vertebrate organs and organ systems.

276. COMPARATIVE PHYSIOLOGY. I. 4 hr. PR: Zool. 273 or equiv. A study of the diverse ways in which different kinds of animals meet their functional requirements.

296, 297. SPECIAL TOPICS. I, II. 1-3 hr. per sem. Critical studies of topics to be determined according to the student's requirements.

331. SPECIAL TOPICS IN COMPARATIVE VERTEBRATE ANATOMY. I, II. 1-4 hr. PR: Consent. Critical studies of topics to be determined in consultation with the instructor.

332. SPECIAL TOPICS IN VERTEBRATE EMBRYOLOGY. I, II. 1-4 hr. PR: Consent. Critical studies of topics to be determined in consultation with the instructor.

351. ADVANCED INVERTEBRATE ZOOLOGY. I, II. 1-4 hr. PR: Zool. 251 and consent.

368. MAMMALOGY. I. 3 hr. PR: Biol. 1 and 2 or equiv., and 8 hr. upper division. The study of mammals and their biological properties with emphasis on the life history, ecology, and distribution of regional forms. Offered only in even-numbered years.

397. RESEARCH. I, II. 1-15 hr.

CHEMISTRY¹

The Department of Chemistry offers graduate studies leading to the degree of Master of Science and Doctor of Philosophy with research concentration in the areas of analytical, inorganic, organic, physical, and theoretical chemistry. Both of these degrees require completion of a research project which represents the principal theme about which the graduate program is constructed.

Applicants for graduate studies in chemistry must have as a minimum requirement a bachelor's degree with a major or concentration in chemistry and an appropriate background in physics and mathematics. All entering graduate students in chemistry are required to take Departmental Guidance Examinations in the major areas of chemistry. These examinations, on the undergraduate level, are administered prior to registration and serve to guide the faculty in recommending a course program for the beginning graduate student. Deficiencies revealed on the Guidance Examinations need to be corrected in a manner prescribed by the faculty before a student may become a candidate for a graduate degree.

The general Graduate School requirements for the Master of Science degree have been outlined elsewhere in this bulletin. Graduate students in the M.S. program in the Department of Chemistry are required to submit a research thesis and thus may enroll in a maximum of 6 hours of research. The remaining 24 hours of credit must be earned in basic graduate courses which reflect a diversified exposure to chemistry; no more than 10 hours may be elected outside the Department of Chemistry. A final oral examination of the M.S. candidate is administered after completion and submission of the thesis.

The program for the degree of Doctor of Philosophy reflects a flexible, research-oriented approach geared to develop the interests, capability and potential of mature students. A program of courses is recommended to suit individual needs based on background, ability, and maturity. These courses are classified as basic graduate courses which present the essentials of a given discipline on an advanced basis, and specialized graduate courses which take one to the frontiers in a specific area of research. The course offerings are designed to provide guidelines from which graduate students can launch their independent studies in preparation for Qualifying and Candidacy Examinations. Students are required to enroll in the departmental seminar program and are expected to attend special lectures and seminars offered by visiting chemists.

The Qualifying Examinations are designed to ascertain the degree of mastery of advanced undergraduate or general first-year graduate level material in at least three of the major areas of chemistry. Upon satisfactory completion of these examinations the student begins the Candidacy Examinations which consist of both a written and oral portion. The written examinations are of the cumulative type and are offered ten times a year. The oral examination is based on a proposition for a research problem not intimately related to the student's own problem, or any particular research problem being actively pursued at West Virginia University. This proposition is presented in writing to the student's research committee and defended before that group and any other interested faculty members.

Completion of the language requirement which may be taken in German and French, or Russian, and satisfactory completion of the candidacy examinations is required before a student is admitted to candidacy for the Ph.D. degree.

Research which is the major theme of graduate studies may be initiated as early as the student and faculty feel appropriate for each individual case. Normally

¹For information concerning courses in chemistry available in the Kanawha Valley Graduate Center of West Virginia University, write to: Director, Kanawha Valley Graduate Center of West Virginia University, P. O. Box 308, Institute, W. Va.

a student will begin laboratory work during his first summer or in September of the following year. Upon successful completion of an original piece of research, the candidate will present his results in a Ph.D. dissertation and at the appropriate time defend his work in a final oral examination.

Details regarding the Graduate School requirements for the M.S. and Ph.D. degrees and information about financial assistance available for graduate students in chemistry can be found in earlier portions of this bulletin. Additional questions on these matters may be directed to the Chairman of the Department of Chemistry.

CHEMISTRY

201. CHEMICAL LITERATURE. I. 2 hr. PR: Organic chemistry. Study of techniques of locating, utilizing, and presenting information needed by the research worker in chemistry.
202. INORGANIC SYNTHESIS. I, II. 2 hr. PR: Chem. 18 or Chem. 15, 16 and 115.
209. INTERMEDIATE ANALYTICAL CHEMISTRY. II. 3 hr. PR: Chem. 261 or concurrent enrollment. Required of chemistry majors.
210. INSTRUMENTAL ANALYSIS. I. 3 hr. PR: Chem. 260 or consent.
214. QUALITATIVE ORGANIC ANALYSIS. I. 3 hr. PR: Chem. 238. This course, or its equivalent, required for all students expecting to do thesis work in organic chemistry. Both chemical and physical methods are used to study unknowns. 1 lect., 2 labs.
221. INTERMEDIATE INORGANIC CHEMISTRY. I. 3 hr. PR: Chem. 261 or concurrent enrollment. Required of chemistry majors. An intensive study of the basic principles of inorganic chemistry, including atomic structure, bonding theories, stereochemistry, acid-base theory, and coordination chemistry.
222. CHEMISTRY OF INORGANIC COMPOUNDS. II. 3 hr. PR: Chem. 221. Reactions and properties of the elements and their compounds.
231. ADVANCED ORGANIC CHEMISTRY I. I. 3 hr. PR: Chem. 238. Structural concepts (orbital representations, resonance, stereochemistry), reaction mechanisms and synthetic applications (condensation reactions, nucleophilic substitution and addition) in organic chemistry at an advanced level.
232. ADVANCED ORGANIC CHEMISTRY II. II. 3 hr. PR: Chem. 231. Synthetic organic chemistry with particular emphasis on aromatic systems, oxidation and reduction techniques, molecular rearrangements, and a review of recent synthetic methods.
233. ORGANIC CHEMISTRY. I. II. 4 hr. PR: Chem. 18 or 115. Required of students who major in chemistry, pharmacy, premedicine, predentistry, and chemical engineering. 3 lect., 1 lab.
238. ORGANIC CHEMISTRY. I, II. 4 hr. PR: Chem. 233. Continuation of Chem. 233. 3 lect., 1 lab.
239. ORGANIC SYNTHESES. I or II. 2 hr. PR: Chem. 238. Modern synthetic methods of organic chemistry.
241. CHEMICAL THERMODYNAMICS. I. 3 hr. PR: Chem. 261.
242. INTRODUCTORY MOLECULAR STRUCTURE. II. 3 hr. PR: Chem. 260. An introduction to the quantum theory of chemical bonding and discussion of experimental methods for determining molecular structure and bond properties.
- 243, 244. SELECTED TOPICS. I, II. 1-3 hr. PR: Consent. Individual investigations under supervision of an instructor.
- 245, 246. HONORS COURSE. I, II. 1-3 hr. PR: Consent. Research for students in the honors programs.
258. PHYSICAL CHEMISTRY LABORATORY. I. 1-2 hr. PR: Chem. 260 or concurrent enrollment. Required of majors in chemistry.

259. PHYSICAL CHEMISTRY LABORATORY. II. 1-2 hr. PR: Chem. 258, 260, and 261 or concurrent enrollment. Required of majors in chemistry.

260. PHYSICAL CHEMISTRY. I. 3 hr. PR: Chem. 233, Physics 102, Math. 17. Required of students who major in chemistry or chemical engineering.

261. PHYSICAL CHEMISTRY. II. 3 hr. PR: Chem. 260. A continuation of Chem. 260.

262. COLLOID AND SURFACE CHEMISTRY. II. 2 hr. PR: Physical chemistry.

270. PRACTICAL INFRARED SPECTROSCOPY. II. 3 hr. PR: Chem. 260 or consent. A practical course for students in chemistry and related fields who may use infrared spectroscopy as a tool in research and applied science.

285. NUCLEAR CHEMISTRY. II. 3 hr. PR: Chem. 260 or equiv. physics. Fundamentals of radioactivity as applied to chemistry and discussion of tracer applications.

311, 312. SEMINAR IN ANALYTICAL CHEMISTRY. I, II. 1 hr. per sem. Current literature and research in the area of analytical chemistry.

313. ELECTROCHEMISTRY AND INSTRUMENTATION. I. 3 hr. PR: Chem. 210. Electronic instrumentation as applied to the study of mass transfer, kinetics of electrode reactions, voltammetry, and high-frequency methods.

314. SPECTROSCOPIC METHODS. II. 3 hr. PR: Chem. 210. Problems in the design of instruments for each of the various spectral regions.

317, 318. ADVANCED TOPICS IN ANALYTICAL CHEMISTRY. I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of analytical chemistry.

321, 322. SEMINAR IN INORGANIC CHEMISTRY. I, II. 1 hr. per sem. Current literature and research in the area of inorganic chemistry.

323. ADVANCED INORGANIC CHEMISTRY. I. 3 hr. PR: Chem. 221. Advanced topics in modern inorganic chemistry including bonding theories, stereochemistry, non-aqueous solvent systems, physical methods and current topics.

324. COORDINATION CHEMISTRY. II. 3 hr. PR: Chem. 346. Ligand field theory, spectral interpretations, stability considerations, synthetic methods, unusual oxidation states, organometallic compounds, other topics of current interest.

325. INORGANIC REACTIONS AND MECHANISMS. I or II. 2 hr. PR: Chem. 323 and 344. A detailed study of substitution, isomerization, racemization, and oxidation-reduction reactions.

326. CHEMISTRY OF NON-METALS. I or II. 3 hr. PR: Chem. 221. Electrodeficient compounds, sulfur-fluorine chemistry, inorganic polymers, rare gas compounds, solid-state chemistry of silicon and germanium, other topics of current interest.

327, 328. ADVANCED TOPICS IN INORGANIC CHEMISTRY. I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of inorganic chemistry.

331, 332. SEMINAR IN ORGANIC CHEMISTRY. I, II. 1 hr. per sem. Current literature and research in the area of organic chemistry.

333. PHYSICAL ORGANIC CHEMISTRY. I. 3 hr. PR: Chem. 231. Theoretical considerations of organic molecules, kinetics and other methods used in the study of organic structure and reaction mechanisms, linear free energy relationship and other related topics.

334. PHYSICAL METHODS IN ORGANIC CHEMISTRY. II. 2 hr. PR: Chem. 231. Application of physical methods (spectroscopy, n.m.r., e.s.r., mass spectroscopy, optical rotatory dispersion, X-ray diffraction, and other methods) to problems in organic chemistry with emphasis on structure elucidation.

335. POLYMER CHEMISTRY. I or II. 2 hr. PR: Chem. 231 and 261. Polymerization processes (methods, reaction types, mechanisms), structural determination and concepts, physical and chemical properties of polymers.

336. HETEROCYCLIC CHEMISTRY. I or II. 3 hr. PR: Chem. 231. A systematic survey of the chemistry of the major heterocyclic systems and discussion of selected natural products containing heterocycles.

337, 338. ADVANCED TOPICS IN ORGANIC CHEMISTRY. I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of organic chemistry.

341, 342. SEMINAR IN PHYSICAL CHEMISTRY. I, II. 1 hr. per sem. Current literature and research in the area of physical chemistry.

343. CHEMICAL KINETICS. II. 3 hr. PR: Chem. 261. Theories and applications of kinetics in gaseous state and in solution.

344. STATISTICAL MECHANICS. I or II. 3 hr. PR: Chem. 346. Theory and application of statistical mechanics to chemical systems.

345. THEORETICAL CHEMISTRY I. I. 3 hr. PR: Differential equations. Theoretical background for quantum mechanics.

346. THEORETICAL CHEMISTRY II. II. 3 hr. PR: Chem. 345. Theories and applications of quantum mechanics in chemistry.

347. MOLECULAR SPECTROSCOPY AND STRUCTURE. I. 3 hr. PR: Chem. 346. An advanced course in the application of spectral methods to a study of molecular structure.

348, 349. ADVANCED TOPICS IN PHYSICAL CHEMISTRY. I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of physical chemistry.

397. RESEARCH. I, II. 1-15 hr. Six hours are required for the Master's degree. Students may enroll more than once. Electrochemistry, crystallography, coordination chemistry, unusual oxidation states, organic and inorganic preparations, organic reaction mechanisms, infrared, microwave, NMR, and radio-frequency spectroscopy, and quantum mechanical calculations are some of the topics currently being investigated.

ECONOMICS

Graduate programs in Economics leading to the Master of Arts and Doctor of Philosophy degrees are listed and discussed under the College of Commerce section on page 105.

ENGLISH LANGUAGE AND LITERATURE

Admission: To be admitted to the Department of English as a prospective candidate for the degree of Master of Arts, a student is expected to have completed work comparable to the Department's undergraduate requirement for English majors and to present a record distinctly above the average.

If as an undergraduate the applicant majored in English, the general average of grades in all English courses must be no lower than B. If the applicant's average in all English courses is lower than B, the Committee on Admissions may extend a "Probational Admission" for one semester, at the end of which the student's status will be determined by the Committee.

If as an undergraduate the applicant majored in a subject other than English, he will be admitted only on condition that he fulfill, to the extent of his particular deficiency, the normal course and credit obligations of the undergraduate English major at West Virginia University. Such an admission is termed a "Conditional Admission."

Course Requirements: A candidate for the M.A. degree will be expected to complete courses covering the major periods and the works of the major authors of English literature. The minimum requirement is 36 hours of graduate work.

Examinations: In addition to the final oral examination related particularly to the student's field of special interest as reflected in the Master's thesis, a graduate student in English is required to take two three-hour comprehensive written examinations in English and American literature. The student will normally take these examinations in the semester or term following that in which he has established

acceptable credit in 24 hours of graduate course work with an average of 3.0. The examinations will be conducted not later than four weeks before the last day of classes of a semester, or three weeks before the end of a summer term. With the permission of the Examining Committee, an unsuccessful candidate may be re-examined. Success in the examination admits the student to candidacy for a graduate degree.

Thesis: For students who have entered or may enter full graduate status in the Department prior to the first semester 1967-68, the writing of a thesis shall remain optional under the terms stated in the *Graduate School Announcements* for 1966-67. A student who enters in the fall of 1967 or later shall be required to write a thesis of a type and on a subject approved by the Department. The student will write under the supervision of a thesis adviser to be assigned. Information about the procedure and the dates for filing application for approval of projects, and about dates for submission of theses, is available at the office of the Department. The thesis may be a work of scholarship, of criticism, or of creative writing (original poetry, drama, or fiction).

The thesis shall count for six hours of graduate credit.

Foreign Language Requirement: A candidate for the degree of Master of Arts in English must have completed studies in a foreign language (preferably French or German) equivalent to 12 semester hours of college work. If an applicant does not meet this requirement, he may prepare to meet it through independent study, or otherwise, in order to show a reading knowledge on examination.

ENGLISH

222. MODERN AMERICAN BIOGRAPHY. I. 3 hr. A selection of the most significant and interesting biographies and autobiographies of Americans of distinction in literature, the arts, and public life.
223. MODERN BRITISH BIOGRAPHY. II. 3 hr. Representative works by such eminent masters of biography as Lytton Strachey, Sir Osbert Sitwell, Lord David Cecil, Sean O'Casey, Hugh Kingsmill, and others.
224. LITERARY CRITICISM. II. 3 hr. The history of literary criticism from Aristotle to modern times.
225. RECENT LITERARY CRITICISM. I, II. 3 hr. A brief survey of the theories and essays of four major schools of modern criticism and an application of these theories to a novel, a play, and to selected poems and short stories.
228. STRUCTURE OF THE ENGLISH LANGUAGE. I, II. 3 hr. A course in historical, comparative, and descriptive grammar, together with an introduction to English linguistics.
230. HISTORY OF THE ENGLISH LANGUAGE. I. 3 hr. A study of the nature of the language; questions of origins, language families, development, relationships of English as one of the Indo-European languages.
231. OLD ENGLISH (I). I. 3 hr. A study of Anglo-Saxon with selected readings from the literature of the period.
232. OLD ENGLISH (II). II. 3 hr. PR: English 231. *Beowulf* and other texts in Old English.
234. CHAUCER. I. 3 hr. Early poems, *Troilus and Criseyde*, and *The Canterbury Tales*. In addition to an understanding and appreciation of Chaucer's works, the student is expected to acquire an adequate knowledge of Chaucer's language.
235. SHAKESPEARE. I. 3 hr. Intensive study of selected plays. Special attention to textual problems and to language and poetic imagery, together with the history of Shakespearean criticism and scholarship.
236. SHAKESPEAREAN COMEDIES AND HISTORY PLAYS. I. 3 hr. A study of representative comedies of Shakespeare against the background of classical and Renaissance theory and practice, and of selected history plays.

237. SHAKESPEAREAN TRAGEDY. II. 3 hr. A study of the principal tragedies of Shakespeare, together with the history of criticism, scholarly investigation, and interpretation.

239. SOUTHERN WRITERS. II. 3 hr. Examination of twentieth-century Southern essayists, poets, short-story writers, and novelists in relation to the ideological background.

242. LITERATURE FOR TEACHERS. S. 3 hr. Study and appreciation of selected works of American authors, with special reference to the high-school curriculum. Given usually in the Summer Session.

243. LITERATURE FOR TEACHERS. S. 3 hr. Study and appreciation of selected works of English authors. Recommended for teachers of high-school English. Given usually in the Summer Session.

244. SIXTEENTH CENTURY PROSE AND POETRY. I. 3 hr. Studies from Caxton to Bacon, from Skelton to Shakespeare.

245. SEVENTEENTH CENTURY PROSE AND POETRY. II. 3 hr. Studies from Donne to Dryden.

247. LITERATURE OF THE EIGHTEENTH CENTURY. I. 3 hr. Literature of the period 1700-1750, studied in relation to the social, political, and religious movements of the time.

248. LITERATURE OF THE EIGHTEENTH CENTURY. II. 3 hr. Continuation of English 247, covering the latter half of the century. May be taken independently of English 247.

249. THE ROMANTIC MOVEMENT. I. 3 hr. The works of Wordsworth, Coleridge, and Keats, together with an introduction to works of scholarship in the field of English Romanticism.

250. AMERICAN ROMANTICISM. II. 3 hr. The writings of Ralph Waldo Emerson, Henry David Thoreau, and Nathaniel Hawthorne. A study of the relations of these men to the history of their own time, and of their contributions to American thought and art.

252. ENGLISH LITERATURE, 1880-1918. 3 hr. A study of the more important writers and literary movements of the late Victorian and the Edwardian periods with emphasis on Hardy, Housman, Hopkins, Henley, Pater, Gissing, Moore, Butler, and the writers of the "Aesthetic movement."

253. EARLY ENGLISH DRAMA. I. 3 hr. A study of the medieval and early Tudor drama, to the age of Shakespeare.

254. ELIZABETHAN DRAMA. II. 3 hr. A study of the dramas of Shakespeare's contemporaries and successors to the closing of the theatres in 1642. Includes Kyd, Marlowe, Peele, Green, Jonson, Heywood, Marston, Chapman, Webster, Beaumont and Fletcher, Massinger, Ford, and Shirley.

255. RESTORATION AND EIGHTEENTH CENTURY DRAMA. II. 3 hr. Comedy, tragedy, the heroic play, the drama of sensibility and the reaction against it: Etherege, Wycherley, Farquhar, Congreve, Vanbrugh, Dryden, Otway, Goldsmith, and Sheridan.

256. MODERN DRAMA. II. 3 hr. A study of world drama from Ibsen to the present day.

257. VICTORIAN POETRY. I. 3 hr. A study of the major Victorian poets—Tennyson, Browning, Arnold, Rossetti, Morris, Swinburne, and Fitzgerald, and a few of the later Victorian poets.

258. VICTORIAN PROSE. II. 3 hr. A study of the non-fictional writings of the great Victorian prose critics: Carlyle, Ruskin, Arnold, Newman, Macaulay, Huxley, and Morris.

261. AMERICAN DRAMA. I. 3 hr. A study of representative American dramas and of the history of the theatre in America.

262. STUDY OF SELECTED AUTHORS. (American). I, II. 3 hr. A study of the works of a principal American author, or of more than one, as announced when the course is scheduled.

263. STUDY OF SELECTED AUTHORS (ENGLISH). I, II. 3 hr. Study of the works of one or more of the principal English authors, as announced in the schedule when the course is listed.

264. SPENSER. I. 3 hr. A study of Spenser's minor poems and *The Faerie Queene*; forms and sources, purpose of the great epic, social, political, and religious allegory.

265. BYRON AND SHELLEY. II. 3 hr. Reading and study of the works of two poets of the later Romantic Movement, together with works of criticism and scholarship related to the period.

267. MILTON. II. 3 hr. A study of all of Milton's poems and of a few selected prose works.

270. AMERICAN POETRY. I. 3 hr. A study of the major American poets of the nineteenth and twentieth centuries—Bryant, Poe, Emerson, Longfellow, Whitman, Dickinson, Frost, Eliot. Primary emphasis on their poetry as poetry; background materials minimized.

272. FOLK LITERATURE. II. 3 hr. A study of the folk ballad, its origin, history, and literary significance, based on Child's collection and on American ballad collections.

275. THE ENGLISH NOVEL TO THE TIME OF SCOTT. I. 3 hr. A study of the English novel from the sixteenth century to the time of Scott, showing the development of the novelistic art from early narrative beginnings.

276. THE ENGLISH NOVEL, 1832-1900. II. 3 hr. A continuation of English 275. The development of the English novel from the early nineteenth century to the beginning of the twentieth century.

278. TRAGEDY. II. 3 hr. Masterpieces of tragedy from Greek times to modern, with consideration of the changing concepts of tragedy and of the ethical and ideological values reflected in the works of major tragic authors.

280. THE MODERN NOVEL. I, II. 3 hr. The twentieth-century novel, with emphasis upon the work of selected British novelists.

282. MODERN BRITISH POETRY. I. 3 hr. A survey of British poetry from 1890 to the present, including the Decadents, Counter-Decadents, Hopkins, Housman, Hardy, the Georgians, the Imagists, and war poets; Yeats, Eliot, the Auden Group, and the post-World War II poets.

291. INTRODUCTION TO LITERARY RESEARCH. I, II. 3 hr. Bibliography; materials and tools of literary investigation; methods of research in various fields of literary history and interpretation; problems of editing. Practical guidance in the writing of theses.

300. THESIS. I, II. 3 hr.

301. THESIS. I, II. 3 hr.

321, 322. MEDIEVAL LITERATURE. I, II. 3 hr. each sem.

331, 332. THE RENAISSANCE. I, II. 3 hr. each sem. PR: Graduate standing. Literary and cultural influences from the Continent on the English literature of the late fifteenth and early sixteenth centuries. Discussion and analysis of major English literary works of the period.

341, 342. ENGLISH DRAMA TO 1642. I, II. 3 hr. each sem. PR: Graduate standing. A consideration of the varied aspects of English drama from its medieval be-

ginnings to the middle of the seventeenth century. Discussion and analysis of selected dramas.

353, 354. THE EIGHTEENTH CENTURY. I, II. 3 hr. each sem.

361, 362. ROMANTICISM. I, II. 3 hr. each sem. PR: Graduate standing. Studies in major authors and special topics in the field of English Romanticism.

371, 372. THE VICTORIAN ERA. I, II. 3 hr. each sem. PR: Graduate standing. Writers of the Victorian period considered in relation to the cultural matrix from which they rise. Particular attention is given to the varying intellectual currents of the era.

377, 378. FOLKLORE AND FOLK LITERATURE. Seminar. 3 hr. each sem. Research projects in folklore, including field work in collecting folklore in the Appalachian region and the analysis of the use of folklore in the works of British and American authors.

392. SEMINAR. I, II. 2 or 3 hr. PR: Specific authors to be approved by the instructor. A graduate study of particular periods or authors.

393, 394. AMERICAN LITERATURE, 1870-. I, II. 3 hr. each sem. PR: Graduate standing. Literary and intellectual America from 1870 to 1914 in terms of leading literary men and changing cultural patterns of the period. Discussion and analysis of selected prose and poetic works.

FOREIGN LANGUAGES

The Department of Foreign Languages offers graduate study in French, Spanish, German, Latin, and Greek literature and culture, in linguistics, in language teaching methods, and in bibliography and research. The department also directs a master's program in Latin American Area Studies. Candidates for the master's degree are accepted in French, Spanish, and German, and in Latin American Area Studies.

A student who wishes to do graduate work in this department should apply to the chairman of the department, who will act as his adviser until the student becomes a candidate for a graduate degree. Usually, he will be expected to have an undergraduate major in a foreign language, preferably the one in which he proposes to major. He should normally show an average of at least 3.0 (B) in his undergraduate foreign language courses.

A candidate must complete at least 36 graduate hours for a master's degree, 24 to 27 hours of which, including Bibliography and Research 265, will be in his major field. A prospective elementary or secondary school teacher, who has not attended an NDEA foreign language institute, is expected to complete Language Teaching Methods 221, 222, or both, as part of the work in the major field. Six hours of the major work may take the form of a master's thesis. The candidate's committee will make all decisions as to the distribution of courses and the thesis requirement in the light of the student's aims and needs.

FRENCH

203. REFRESHER COURSE IN CONVERSATIONAL FRENCH. 3 hr. PR: A.B. in French or consent. Intensive spoken French designed primarily for teachers of French in the elementary school.

205. FUNDAMENTALS FOR READING FRENCH. I. 3 hr. Undergraduate credit only. Graduate students must register as auditors. PR: Graduate status or upper-division status. The sequence 205-206 is intended for graduate students from other departments to teach them to read general and technical French.

206. READING FRENCH. II. 3 hr. Undergraduate credit only. Graduate students must register as auditors. PR: 12 hr. of French or equiv. or French 205. Graduate students may meet the doctoral foreign language requirement by achieving a grade of B or better in this course. Not open to Foreign Language Department majors.

217. FRENCH CIVILIZATION. II. 3 hr. PR: 12 hr. of French.

- 221. THE ROMANTIC MOVEMENT. I. 3 hr. PR: French 118 or consent.
- 222. FRENCH REALISM. II. 3 hr. PR: French 118 or consent.
- 226. LITERARY CRITICISM. II. 3 hr. PR: A.B. in French or consent.
- 227. GRADUATE READING IN FRENCH. No Credit. A special course to help students prepare for the Ph.D. reading examination in French.
- 229. LITERATURE OF THE 16TH CENTURY. I. 3 hr. PR: A.B. in French or consent.
- 231. PHONETICS AND PRONUNCIATION. II. 3 hr. PR: 18 hr. of French or equiv.
- 237. MOLIERE. II. 3 hr. PR: French 115.
- 241. FRENCH STRUCTURAL LINGUISTICS. 4 hr. PR: 12 hr. of French. A special course for the NDEA Language Institute.
- 242. METHODS IN FRENCH SECONDARY TEACHING. 4 hr. PR: 12 hr. of French. A special course for the NDEA Language Institute.
- 244. EXPLICATION DE TEXTES. II. 3 hr. PR: 18 hr. of French or equiv.
- 271. THE MODERN NOVEL TO 1930. I. 3 hr. PR: A.B. in French or consent.
- 272. THE NOVEL AFTER 1930. II. 3 hr. PR: A.B. in French or consent.
- 281. MEDIEVAL FRENCH LITERATURE. II. 3 hr. PR: Linguistics 290 (Old French) or consent.
- 292. PRO-SEMINAR IN FRENCH LITERATURE. 1-6 hr. Special topics.
- 301. THESIS. 3-6 hr.
- 392. SEMINAR IN FRENCH LITERATURE. 1-6 hr. Special topics.

SPANISH

- 211. NINETEENTH CENTURY LITERATURE TO 1870. I. 3 hr. PR: Spanish 3 and 4, or equiv.
- 212. SPANISH LITERATURE SINCE 1870. II. 3 hr. PR: Spanish 3 and 4, or equiv.
- 215. LYRIC POETRY. I. 3 hr. PR: 12 hr. of Spanish, or equiv.
- 216. SPANISH CIVILIZATION AND CULTURE. I. 3 hr. PR: 12 hr. of Spanish, or equiv.
- 217. SPANISH-AMERICAN LITERATURE AND CULTURE. I. 3 hr. PR: 12 hr. of Spanish, or equiv.
- 218. SPANISH-AMERICAN LITERATURE AND CULTURE. II. 3 hr. PR: 12 hr. of Spanish, or equiv. Continuation of Spanish 217.
- 221. LITERATURE OF THE GOLDEN AGE TO 1635. I. 3 hr. PR: 18 hr. of Spanish, or equiv.
- 222. THE GOLDEN AGE AFTER LOPE DE VEGA. II. 3 hr. PR: 18 hr. of Spanish, or equiv.
- 223. ESTUDIOS DE ESTILLO. I. 3 hr. PR: 18 hr. of Spanish, or equiv.
- 224. EXPLICACION DE TEXTOS. II. 3 hr. PR: 18 hr. of Spanish, or equiv.
- 225. THE PICARESQUE NOVEL. I. 3 hr. PR: 18 hr. of Spanish, or equiv.
- 227. GRADUATE READING IN SPANISH. No credit. A special course to help students prepare for the Ph.D. reading examination in Spanish.
- 241. SPANISH STRUCTURAL LINGUISTICS. 4 hr. PR: 12 hr. of Spanish. A special course for the NDEA Language Institute.
- 242. METHODS IN SPANISH SECONDARY TEACHING. 4 hr. PR: 12 hr. of Spanish. A special course for the NDEA Language Institute.

- 291. CERVANTES. II. 3 hr. PR: 18 hr. of Spanish or consent.
- 292. PRO-SEMINAR IN SPANISH LITERATURE. 1-6 hr. Special topics.
- 295. SIXTEENTH CENTURY LITERATURE. I. 3 hr.
- 297. PRO-SEMINAR IN SPANISH-AMERICAN STUDIES, 1-6 hr. Special topics.
- 301. THESIS. 3-6 hr.
- 392. SEMINAR IN SPANISH LITERATURE. 1-6 hr. Special topics.
- 395. SEMINAR IN SPANISH-AMERICAN STUDIES. 1-6 hr. Special topics.

GERMAN

- 201. INDEPENDENT READING. I. 3 hr. Supervised reading for students who wish to do intensive work in any field of interest.
- 202. INDEPENDENT READING. II. 3 hr. Continuation of German 201.
- 227. GRADUATE READING IN GERMAN. No credit. A special course to help students prepare for the Ph.D. reading examination in German.
- 242. FAUST. II. 3 hr. PR: German 4 or consent. Critical study of Goethe's *Faust*.
- 243. MEDIEVAL GERMAN LITERATURE. I. 3 hr. PR: German 4 or consent.
- 244. GERMAN LITERATURE OF THE REFORMATION AND RENAISSANCE. II. 3 hr. PR: German 4 or consent.
- 245. CLASSICISM AND ROMANTICISM. I. 3 hr. PR: German 4 or consent. A critical study of German literature from 1750 to 1830.
- 246. THE LIBERAL AGE. II. 3 hr. PR: German 4 or consent. A critical study of German literature from 1830 to 1880, with an emphasis upon poetic realism.
- 247. THE AGE OF CRISIS. II. 3 hr. PR: German 4 or consent. A critical study of German literature from 1880 to the present.
- 265. GERMAN CIVILIZATION. I. 3 hr. PR: 12 hr. of German or consent. A general comprehensive survey of the most important aspects of German culture, including a brief historical background, the development of the German language, geography, science, music, art, architecture, literature, and philosophy.
- 275. THE MODERN NOVEL. I. 3 hr. PR: 18 hr. of German. Supervised reading of nineteenth century novels.
- 276. THE MODERN NOVEL. II. 3 hr. Continuation of German 275, with emphasis on recent fiction.
- 292. PRO-SEMINAR IN GERMAN LITERATURE. 1-6 hr. Special topics.
- 301. THESIS. 3-6 hr.
- 392. SEMINAR IN GERMAN LITERATURE. 1-6 hr. Special topics.

RUSSIAN

- 211. THE RUSSIAN NOVEL. I. 3 hr. PR: Russian 3 and 4 or consent. Study of selected work of Gogol, Goncharov, Turgenev, Leskov, Dostoevsky, and Tolstoy.
- 212. THE RUSSIAN NOVEL. II. 3 hr. Continuation of Russian 211. Study of Russian prose from Chekhov to the post-war Soviet novelists.

LATIN

- 201. THE STORY AND NOVEL. I. 3 hr. PR: Latin 109, 110, or equiv. The origin of the story and novel is traced from Homer to the Medieval Greek and Latin romance writers. Selection from Petronius, the *Cena Trimalchionis*, and from Apuleius, *Cupid and Psyche*.

202. DRAMA. II. 3 hr. PR: Latin 109, 110, or equiv. A brief history of the origin and development of Greek and Roman drama. The *Menaechmi* of Plautus, the *Andria* of Terence, and the *Medea* of Seneca are read.

203. ORATORY. II. 3 hr. PR: Latin 109, 110, or equiv. A survey of Greek and Roman oratory is given and part of the first book of Cicero's *De Oratore*; selections from Quintilian's *Institutes* and from Tacitus' *Dialogus de Oratoribus* are read.

227. GRADUATE READING IN LATIN. No credit. A special course to help students prepare for the Ph.D. reading examination in Latin.

231. SATIRE. I. 3 hr. PR: Latin 109, 110, or equiv. Greek satirical writings and the origin of the Roman satire. Selections from the *Satires* and *Epistles* of Horace, and from the *Satires* of Persius and Juvenal.

234. HISTORY. I. 3 hr. PR: Latin 109, 110, or equiv. The origin and development of Roman historiography and its Greek antecedents. Selections from Livy's *History*, from Tacitus' *Agricola*, and from Suetonius' *Julius Caesar*.

235. EPIC. I. 3 hr. PR: Latin 109, 110, or equiv. The origin and development of the Greek and Roman epic. Selections from Vergil's *Aeneid*, from Lucretius' *De Rerum Natura*, and from the earlier and later epic poets.

236. PHILOSOPHY. II. 3 hr. PR: Latin 109, 110, or equiv. The origin and development of Greek philosophy and its influence upon Roman philosophy. Selections from Cicero's *Tusculan Disputations* on the immortality of the soul and from Seneca's *Epistles*.

292. PRO-SEMINAR IN LATIN LITERATURE. 1-6 hr. Special topics.

301. THESIS. 3-6. hr.

392. SEMINAR IN LATIN LITERATURE. 1-6 hr. Special topics.

GREEK

292. PRO-SEMINAR IN GREEK LITERATURE. 1-6 hr. Special topics.

392. SEMINAR IN GREEK LITERATURE. 1-6 hr. Special topics.

LINGUISTICS

201. LINGUISTICS AS APPLIED TO SPANISH AMERICAN DIALECTS. I. 3 hr. PR: A.B. in Spanish or consent. For students majoring in Latin American Area Studies to acquaint them with the principles of structural linguistics and those points of structure and vocabulary in which American Spanish differs from standard Castilian.

211. MIDDLE HIGH GERMAN. I. 3 hr. PR: 12 hr. of German from upper division. Study of the linguistic developments of Middle High German from the eleventh to the fifteenth centuries with illustrative reading from the *Nibelungenlied*.

212. MIDDLE HIGH GERMAN. II. 3 hr. Continuation of Linguistics 211 with illustrative readings from the Middle High German lyric poets and the courtly epics.

225. COMPARATIVE GRAMMAR OF GREEK AND LATIN. I. 3 hr. PR: Consent.

226. ITALIC DIALECTS. II. 3 hr. Consent.

227. VULGAR LATIN. II. 3 hr. PR: Latin 109, 110, or equiv. Selections from Latin inscriptions and later Latin literature are studied to illustrate the development of the Latin language from its earliest times to its passing into the Romance languages.

231. THE STRUCTURE OF MODERN RUSSIAN. I. 3 hr. PR: Russian 3 and 4 or consent. Advanced study of Russian phonetics and phonemics.

232. THE STRUCTURE OF MODERN RUSSIAN. II. 3 hr. PR: Linguistics 231 or consent. Advanced study of Russian morphology and syntax.

241. *See French* 241 and *Spanish* 241.

251. HISTORY OF THE GERMAN LANGUAGE. I. 3 hr. PR: 18 hr. of German or consent. A study of the historical development of standard German with emphasis on its relationships to the other Germanic languages and dialects.

252. COMPARATIVE GERMANIC LINGUISTICS. II. 3 hr. PR: Linguistics 251 or consent. A comparative study of Gothic, Old English, Old Norse, Old High German, and Old Saxon.

255. HISTORY OF THE SPANISH LANGUAGE. I. 3 hr. PR: A.B. in Spanish or consent. A study of the development of the Spanish language and of the transformation of the Castilian dialect into the national language of Spain.

271. OLD ENGLISH. I. 3 hr. PR: Consent. Elementary study of Old West Saxon with illustrative materials from prose and poetry.

272. OLD ENGLISH. II. 3 hr. Continuation of Linguistics 271. Comparison of the Old English dialects, with extensive illustrative readings, especially in *Beowulf*.

281. OLD NORSE. I. 3 hr. PR: Consent. Elementary study of Old West Norse prose.

282. OLD NORSE. II. 3 hr. Continuation of Linguistics 281. Readings in various Old Icelandic sagas; introduction to Old Norse poetry.

290. OLD FRENCH. II. 3 hr. PR: Consent.

292. PRO-SEMINAR IN LINGUISTICS. 1-6 hr. Special topics.

296. OLD SPANISH. II. 3 hr. PR: Consent.

392. SEMINAR IN LINGUISTICS. 1-6 hr. Special topics.

LANGUAGE TEACHING METHODS

221. METHODS AND MATERIALS IN THE TEACHING OF FOREIGN LANGUAGE. I. 3 hr. Required of all prospective elementary and secondary school teachers majoring in foreign language.

222. LANGUAGE LABORATORY TECHNIQUES. II. 3 hr. Required of all candidates for a graduate degree in a foreign language.

242. *See French 242 and Spanish 242.*

270. PROBLEMS IN TEACHING FOREIGN LANGUAGES IN THE ELEMENTARY SCHOOL (FRENCH, SPANISH, GERMAN, RUSSIAN). 3 hr. PR: Consent. A methods course in the teaching of foreign languages with a demonstration class of elementary school pupils.

BIBLIOGRAPHY AND RESEARCH

265. METHODS OF RESEARCH. I. 3 hr.

LATIN AMERICAN AREA STUDIES

The Master of Arts degree in Latin American Area Studies is an interdisciplinary degree. It is based on 39 credit hours, six of which may be obtained in residence at a selected Latin American university.

The courses are intended for graduate students who hold a bachelor's degree, preferably with a major in Spanish, History, Economics, Political Science, Geology, or Sociology and who wish to prepare themselves for some type of work in Latin America.

Each candidate accepted will be assigned to a committee composed of at least one member from the Department of Foreign Languages and other members from the supporting departments.

The objectives of the program are: to make sure the student has a thorough knowledge of Spanish for all purposes, to furnish the student a good background in Latin American culture, and to give the student a sound basis for future teaching, research, or other professional work requiring knowledge of Latin America.

Basic requirements for all candidates are: Spanish 217, 218, 297, 395, Linguistics 201, Geography 219.

Additional courses under this program are grouped as follows:

Group I. History 220, 221, Political Science 246, 255, 267.

Group II. Economics 250, 251, Sociology 260, and six hours of special courses in Anthropology.

Group III. Art 275, Botany 296, Agriculture 320, three hours of special work in Pathology.

The students may complete the requirements for his degree in either of the following ways:

1. At least nine hours from Group I and three hours from Group III, plus additional courses from Groups I, II, or III as desired.

2. At least nine hours from Group II and three hours from Group III, plus additional courses from Groups I, II, or III as desired.

GEOLOGY AND GEOGRAPHY

The Department of Geology and Geography offers work leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy in Geology. No graduate degrees are offered in Geography.

THE DEGREE OF MASTER OF ARTS

This degree enables the holder of a baccalaureate degree to become well acquainted, although not professionally trained, in the earth sciences. The program is directed toward teachers, businessmen, and research administrators.

Acceptance by the Graduate School and also by the Department of Geology and Geography is necessary before admission of any prospective student to the program. One departmental requirement is previous college study of scientific subjects. This requirement may be fulfilled by an undergraduate major (or first teaching field) in biology, chemistry, physics, or engineering.

The minimum course work involved is 36 hours (32 of which are at graduate level). This includes 24 hours of specified work, and allows 12 or more hours in optional and related areas (at least 3 hours of which are in geology). Up to 9 hours of cognate work at the graduate level (in biology, chemistry, physics, engineering, mathematics, or education) may be included in the program. No thesis is required. The degree program may be completed during residence in one Summer Session and two regular semesters.

THE DEGREE OF MASTER OF SCIENCE

Before being admitted to candidacy for the Master of Science degree in Geology, the student must have completed the equivalent of the courses listed in the college of Arts and Sciences section of the *Undergraduate Catalog* as curricular requirements for undergraduates majoring in Geology. Students who have not had more than a year of physics, a year of chemistry, and mathematics through Math. 15 ('Calculus I'), will be required to meet these requirements. They therefore will spend more than the minimum time for the Master of Science or Doctor of Philosophy degrees. Most employment requirements in technical fields, such as petroleum geology, now include not only advanced physics and chemistry but also mathematics through calculus. Employment opportunities are limited unless this requirement is met. Graduate students are expected to take some supporting courses in such allied fields as mining engineering, geophysics, and biology—depending on their major field of geologic studies.

A grade-point average of at least 3.0 (B) is required for an advanced degree in all courses in geology taken in the department while a graduate student. Scores in the general aptitude and geology tests of the Graduate Record Examination must be submitted. Each student must pass satisfactorily a comprehensive qualifying examination as an additional requirement before being admitted to candidacy for an advanced degree.

A thesis is required of all candidates for the Master of Science degree in geology. The thesis may be based on field work done while not in residence at the University by arrangement with the candidate's advisory committee. Final examinations (usually oral) on general geologic knowledge and thesis subject must be passed by each candidate for an advanced degree.

Prospective students are urged to write the Chairman of the Department of Geology before making application to the Director of Admissions of the University for admission to the Graduate School.

THE DEGREE OF DOCTOR OF PHILOSOPHY

In addition to the requirements above, the general requirements for the Doctor's degree are set forth in Part II of this bulletin.

OPPORTUNITIES FOR RESEARCH

Close cooperation between the West Virginia Geological and Economic Survey, located in Morgantown, and the Department of Geology makes a large amount of material available for laboratory investigation. This includes the fossil collections of the Department and the Survey. A large number of samples of drill cuttings from deep wells in West Virginia and adjoining states are housed in the Survey. Morgantown is conveniently situated for detailed studies of Mississippian, Pennsylvanian, and Permian formations. Mineral products of the region near Morgantown include coal, petroleum, natural gas, and limestone. The occurrence and utilization of these materials can be studied by graduate students interested in economic geology. A permanent summer field camp (Camp Wood) is located in the Folded Appalachians at Alvon, Greenbrier County, West Virginia.

GEOLOGY

201. PHYSICAL GEOLOGY FOR TEACHERS. I, II, S. 3 hr. PR: High School teaching certificate, and consent. Composition and structure of earth and the geologic processes which shape its surface.
202. PHYSICAL GEOLOGY LABORATORY FOR TEACHERS. I, II, S. 1 hr. Accompanies Geol. 201. Laboratory and field study of earth materials and features, and the topographic and geologic maps used to represent them.
221. GEOMORPHOLOGY. I. 3 hr. Study of surface features of eastern United States.
222. GEOMORPHOLOGY. II. 3 hr. Study of surface features of western United States.
228. PHOTOGEOLOGY. II. 3 hr. PR: Geol. 127, 151. Instruction in basic and advanced techniques of air photo interpretation.
231. INVERTEBRATE PALEONTOLOGY. II. 4 hr. PR: Geol. 3, 4. Invertebrate fossils; biologic classification, evolutionary development, and use in correlation of strata.
235. INTRODUCTORY PALEOBOTANY. I, II. 4 hr. PR: Geol. 3 and/or Bot. 2. Resume of development of principal plant groups through the ages, present distribution, mode of occurrence and index species, methods of collection.
261. STRATIGRAPHY AND SEDIMENTATION. II. 3 hr. Study of sediments and sedimentary rocks. Field techniques stressed as data gathered and interpreted from rocks of Pennsylvanian age in Morgantown vicinity. Two-day field trip required.
263. GROUND-WATER HYDROLOGY. II. 3 hr. PR: Geol. 1 or consent. Study of the principles of ground-water hydrology; occurrence, development, uses, and conservation of ground-water.
266. APPALACHIAN GEOLOGY FIELD CAMP. S. 6 hr. PR: Geol. 231, 261. Practical experience in detailed geological field procedures and mapping. Living expenses in addition to tuition must be paid at time of registration.
269. X-RAY DIFFRACTION. I, II. 2 hr. The theory of X-ray diffraction and application to the analysis of crystalline materials using the powder camera and X-ray diffractometer. Open to advanced students in geology, chemistry, engineering and related fields with consent of instructor.
270. MINERAL RESOURCES. I, S. 3 hr. PR: Geol. 1, 2. General survey of character, origin, and distribution of natural mineral resources, including mineral fuels, nonmetallic minerals, ore deposits, and ground-water.
272. PETROLEUM GEOLOGY. II. 3-4 hr. PR: Geol. 151. Origin, geologic distribution, methods of exploration and exploitation, uses and future reserves of petroleum and natural gas in the world.

285. OPTICAL MINERALOGY. I. 4 hr. PR: Geol. 185 and one year of Physics. Principles and practice in use of the petrographic microscope in identification of minerals. Emphasis on determination by immersion method.

290. GEOLOGIC PROBLEMS. I, II. 1-6 hr. Special problems for seniors and graduates.

291. SEMINAR. I. 1 hr.

294. INTRODUCTORY GEOCHEMISTRY. I. 3 hr. PR: Geol. 185 or consent. Evolution of earth as suggested by chemical and physical data, followed by topics of current interest, including geologic thermometry, oxidation potential and pH, and geochemical prospecting.

295. GEOCHEMISTRY. II. 3 hr. PR: Geol. 185 or consent. Mineral systems at low temperatures and low pressures considered in terms of partial pressure, oxidation potential and pH. Laboratory study includes directed investigation of a topic of interest to the student.

329. PROBLEMS IN GEOMORPHOLOGY. I, II. 1-4 hr.

332. MICROPALAEONTOLOGY. I. 4 hr. PR: Geol. 231. Identification of Foraminifera and Ostracoda; emphasis on classification, nomenclature, and use of paleontological literature.

334. PROBLEMS IN PALEONTOLOGY. I, II. 1-4 hr.

336. ADVANCED PALEOBOTANY. I, II. 4 hr. Continuation of Geol. 235.

339. PROBLEMS IN PALEOBOTANY. I, II. 1-4 hr.

340. ADVANCED STRATIGRAPHY. II. 4 hr. PR: Geol. 231. Study of principles of rock and time correlation, emphasis on their application to the stratigraphy of West Virginia.

346. ADVANCED SEDIMENTATION. I. 4 hr. PR: Geol. 185. Origin of sedimentary rocks; principles involved in interpretation of ancient geography, climates, animals, and plants.

348. PROBLEMS IN SEDIMENTATION. I, II. 1-4 hr.

349. PROBLEMS IN STRATIGRAPHY. I, II. 1-4 hr.

351. TECTONIC ELEMENTS. II. 3 hr. PR: Geol. 151. Detailed analyses of tectonic elements of North America and Europe.

359. PROBLEMS IN STRUCTURAL GEOLOGY. I, II. 1-4 hr.

366. PROBLEMS IN FIELD GEOLOGY. I, II. 1-6 hr.

371. ECONOMIC GEOLOGY: ORE DEPOSITS. II. 3 hr. PR: Geol. 185. Mineral composition, geologic features, and distribution of deposits of principal useful metallic minerals.

372. ECONOMIC GEOLOGY: NONMETALLICS. I. 3 hr. PR: Geol. 185. Occurrence, formation, and use of nonmetallic mineral substances, including building materials and chemicals.

374. PROBLEMS IN ECONOMIC GEOLOGY AND GEOCHEMISTRY. I, II. 1-4 hr.

386. PETROLOGY. II. 4 hr. PR: Geol. 285. Composition, texture, occurrence, and origin of rocks. Study of hand specimens and thin sections.

387. ADVANCED PETROLOGY. I. 3 hr. PR: Geol. 386. Study of the composition, classification, and origin of igneous and metamorphic rocks. Laboratory work consists of a study of crystalline rocks by microscopical methods.

388. PROBLEMS IN MINERALOGY AND PETROLOGY. I, II. 1-4 hr.

397. RESEARCH. I, II. 1-15 hr.; max. 15 hr. per sem. Students may enroll more than once for this course.

GEOGRAPHY

- 214. **HISTORICAL GEOGRAPHY OF ANGLO-AMERICA.** II. 3 hr. Exploration, settlement, and changing patterns of human occupancy from the sixteenth century to the present; cultural areas and their significance.
- 216. **URBAN GEOGRAPHY.** II. 3 hr. Location, development, and change of urban land use patterns.
- 219. **PROBLEMS IN GEOGRAPHY.** I, II. 1-3 hr. per sem. PR: Consent.

HISTORY

THE DEGREE OF MASTER OF ARTS

Candidates for the Master's degree should have had 18 hours of upper-division undergraduate work in history and 9 hours of upper-division undergraduate work in some closely related subject, preferably economics, political science, or sociology. A reading knowledge of one foreign language is desirable.

The Department of History requires that all candidates for the Master of Arts degree in history present an overall average of 3.0 (B) for all graduate course taken; it will not accept toward an advanced degree credits in courses offered by the Department of History which are reported with a grade lower than "B."

Early in the course the candidate should select a thesis subject, the development of which will require research of at least a semi-independent character. Before the degree is conferred the candidate will be required to pass a satisfactory examination in the field of his thesis and such related fields as may be determined by him in conference with his departmental adviser.

The thesis must be in the hands of the departmental adviser at least thirty days before date of the oral examination, which will be conducted by a committee selected by the adviser and approved by the Dean of the Graduate School. Four hours credit will be allowed for an acceptable thesis. With the approval of the adviser, the candidate for the Master's degree may substitute course work for the thesis requirement, provided that he shall have satisfactorily completed 36 semester hours of graduate study, which shall include a minimum of 24 hours in History, at least 6 of which shall include courses of the 300 seminar series. Those electing to obtain the Master's degree by this option will be required to pass a final comprehensive examination (either oral, written, or both) in the fields covered by the course work.

THE DEGREE OF DOCTOR OF PHILOSOPHY

A candidate for the Doctor's degree must offer a program of study in at least four fields, three of which must be in history and the other may be in a related field in another department. The program must be approved by the departmental adviser and the Dean of the Graduate School, but not until the candidate has shown his ability to pursue it by a qualifying examination, given by a committee of the Department, to determine his general knowledge of the entire field of history.

In addition to the qualifying examination, a candidate for the degree shall submit, before the end of the first year of his residence, a piece of research approved by the departmental adviser to satisfy the Department of History of his fitness to proceed with graduate work. After a period of residence, but not until he shall have met the University requirement of ability to read two foreign languages, the candidate will be required to take a comprehensive preliminary examination (oral, written, or both) in four fields, of which three must be in history.

The groups from which the fields may be selected are:

Group A—

History of the United States to 1865
History of the United States since 1850

Group B—

Medieval and Renaissance Europe
Europe, 1500-1815
Europe, 1789 to Present
History of England

Group C—

Latin America
History of Asia
Field in another department

Besides conforming to general regulations of the Graduate School, the doctor's dissertation must show: (1) a thorough mastery of the original sources of information; (2) good literary form or style; and (3) an acceptable standard of documentation, to the end that all important statements of fact may be verified. Upon the satisfactory completion of the dissertation, the candidate is required to take a final oral examination. This examination is designed to bring out the candidate's critical ability and reasoning power and is based on the field covered by the dissertation.

HISTORY

- 202. MEDIEVAL CULTURAL HISTORY. 3 hr.
- 203. THE RENAISSANCE AND THE REFORMATION. 3 hr.
- 204. ENGLISH SOCIAL HISTORY, 14TH TO 18TH CENTURY. 3 hr.
- 205. ENGLISH SOCIAL HISTORY, 18TH CENTURY TO THE PRESENT. 3 hr.
- 206. FRENCH REVOLUTION AND NAPOLEON. 3 hr.
- 207. HISTORY OF MODERN FRANCE. 3 hr.
- 208. HISTORY OF RUSSIA FROM ANCIENT TIMES TO ALEXANDER III. 3 hr.
- 209. HISTORY OF RUSSIA: THE REVOLUTIONARY ERA AND THE SOVIET PERIOD. 3 hr.
- 210. EUROPEAN DIPLOMATIC HISTORY, 1815 TO 1919. 3 hr.
- 221. EUROPEAN DIPLOMATIC HISTORY, 1919 TO PRESENT. 3 hr.
- 212. HISTORY OF GERMANY FROM THE ROMAN ERA TO THE EARLY 19TH CENTURY. 3 hr.
- 213. HISTORY OF MODERN GERMANY. 3 hr.
- 214. HISTORY OF MODERN SPAIN. 3 hr.
- 215. PROBLEMS OF THE PACIFIC. 3 hr.
- 230. THE ABC POWERS OF LATIN AMERICA. 3 hr.
- 250. ECONOMIC AND SOCIAL DEVELOPMENT OF WEST VIRGINIA. 3 hr.
- 253. THE AMERICAN FRONTIER EAST OF THE MISSISSIPPI. 3 hr.
- 254. THE AMERICAN FRONTIER WEST OF THE MISSISSIPPI. 3 hr.
- 256. THE OLD SOUTH. 3 hr.
- 257. THE AMERICAN CIVIL WAR. 3 hr.
- 258. THE NEW SOUTH. 3 hr.
- 259. THE UNITED STATES FROM MCKINLEY TO THE NEW DEAL, 1899 TO 1933. 3 hr.
- 260. AMERICAN DIPLOMACY TO 1901. 3 hr.
- 261. AMERICAN FOREIGN POLICY AND DIPLOMACY, 1901 TO THE PRESENT. 3 hr.
- 269. RECENT AMERICAN HISTORY, 1933 TO THE PRESENT. 3 hr.
- 279. AMERICAN ECONOMIC HISTORY TO 1865. 3 hr.
- 280. AMERICAN ECONOMIC HISTORY SINCE 1865. 3 hr.
- 281. THE AMERICAN LABOR MOVEMENT. 3 hr.
- 290. INTELLECTUAL AND SOCIAL HISTORY OF THE UNITED STATES TO 1876. 3 hr.

291. INTELLECTUAL SOCIAL HISTORY OF THE UNITED STATES SINCE 1876. 3 hr.

292. EUROPEAN INTELLECTUAL HISTORY TO THE AGE OF THE ENLIGHTENMENT. 3 hr.

293. EUROPEAN INTELLECTUAL HISTORY FROM THE AGE OF THE ENLIGHTENMENT TO THE PRESENT. 3 hr.

302, 303. READINGS, SEMINAR, IN MEDIEVAL HISTORY. 3 hr.

304, 305. READINGS, SEMINAR, IN ENGLISH HISTORY. 3 hr.

306, 307. READINGS, SEMINAR, IN WESTERN EUROPEAN HISTORY. 3 hr.

308, 309. READINGS, SEMINAR, IN CENTRAL EUROPEAN HISTORY. 3 hr.

310, 311. READINGS, SEMINAR, IN EASTERN EUROPEAN HISTORY. 3 hr.

312, 313. READINGS, SEMINAR, IN ASIAN HISTORY. 3 hr.

349, 350. PROBLEMS IN LOCAL AND REGIONAL HISTORY. 3 hr.

351, 352. READINGS, SEMINAR, IN AMERICAN HISTORY, 1492-1789. 3 hr.

353, 354. READINGS, SEMINAR, IN AMERICAN HISTORY, 1763-1865. 3 hr.

355, 356. READINGS, SEMINAR, IN AMERICAN HISTORY, 1850-1898. 3 hr.

357, 358. READINGS, SEMINAR IN AMERICAN HISTORY, 1890 TO THE PRESENT. 3 hr.

359, 360. READINGS, SEMINAR, IN FRONTIER HISTORY. 3 hr.

361. THE HISTORY OF AMERICAN AGRICULTURE. 3 hr.

362. THE CLEVELAND ERA. 3 hr.

376. AMERICAN HISTORIOGRAPHY. 3 hr.

377. EUROPEAN HISTORIOGRAPHY. 3 hr.

391, 392. THESIS. 1-6 hr.

393, 394. RESEARCH. 1-15 hr.; max. 15 hr. per sem.

LIBRARY SCIENCE

Admission Requirements: Students wishing to do graduate work in Library Science must satisfy the general requirements for admission to the Graduate School.

The Department of Library Science offers a graduate program which culminates in a Master of Arts degree in Education with a field in Library Science. This degree is granted in conjunction with the College of Human Resources and Education and the Graduate School.

The student will be admitted to the graduate program when he has met the following Departmental requirements:

1. A Bachelor's degree from an approved college or university with evidence of 9 semester hours credit in the following Library Science courses or equivalents:
 101. Basic Reference
 203. Library Materials for Children
 223. Cataloging and Classification
2. A broad cultural background with a field of specialization.
3. Evidence of ability to undertake the completion of the Library Science program as well as promise of professional proficiency as shown by previous academic record.
4. A personal interview whenever possible.

Degree Requirements: The candidate for the Master of Arts in Education degree with a field in Library Science will be required to complete 30 semester hours of graduate study consisting of:

(1) a. Eighteen graduate hours in Library Science, with an average of B, of which at least 3 hours will be in courses of "300" number; or,
b. Twelve graduate hours in Library Science, with an average of B, of which at least 3 hours will be in courses of "300" number, and 6 graduate hours in a related field (with faculty adviser approval) with an average of B.

(2) a. Nine hours in Education, with an average of B, to include 3 hours of required audio-visual and 6 hours of electives.
b. A 3-hour problem report (Ed. 360) in some phase of librarianship; thus completing the 30 semester hours necessary for the degree.

LIBRARY SCIENCE

203. **LIBRARY MATERIALS FOR CHILDREN.** I. S. 3 hr. A survey of the development of children's literature with emphasis on modern books.

205. **SELECTION OF BOOKS AND RELATED MATERIALS FOR THE SECONDARY SCHOOL LIBRARY.** A survey of adolescent literature and other library materials adapted to the needs of high school students.

207. **ORGANIZATION AND ADMINISTRATION OF THE INSTRUCTIONAL MATERIALS CENTER IN THE SECONDARY SCHOOL.** I, S. 3 hr. A study of organization and administration of instructional materials center, including planning, equipment, routines and schedules.

221. **PUBLIC AND REGIONAL LIBRARY SERVICE.** S. 3 hr. PR: Consent. Principles governing the administration of tax-supported public libraries and the development of larger units of service.

222. **FIELD PRACTICE.** I, S. 3 hr. Practical experience in a variety of public, school, and special libraries under the supervision of experienced librarians. 100 clock hours must be completed by the student. PR: Lib. Sci. 1 or 101, 203 or 205, 207, 223.

223. **CATALOGING AND CLASSIFICATION.** I, S. 3 hr. Basic principles and problems of cataloging and classification combined with practical experience in processing the various types of books and materials. Problems peculiar to the teacher-librarian will be considered.

224. **HISTORY OF BOOKS AND LIBRARIES.** II, S. 3 hr. A survey course, including the development of the book from early manuscript form, history of printing, printers, book illustration, bindings, and the library and its development.

225. **BOOKS AND READING FOR ADULTS.** II, S. 3 hr. Reading and evaluation of representative books in broad subject fields.

226. **LITERATURE OF THE SOCIAL SCIENCES.** II, S. 3 hr. PR: Consent. An approach to the selection and use of books and materials in the social sciences.

227. **LITERATURE OF THE HUMANITIES.** II, S. 3 hr. Bibliographical and other reference sources in the major subject areas of the humanities, including religion, philosophy, fine arts, music, and literature.

228. **LITERATURE OF SCIENCE AND TECHNOLOGY.** II, S. 3 hr. PR: Consent. A course designed to give the student a good working knowledge of the increasingly complex literature of science and technology.

230. **LIBRARY RESOURCES FOR THE SCHOOL CURRICULUM.** II. 3 hr. Broadened experiences in both library and outside resources that lend themselves to curriculum enrichment, including guidance, remedial reading, text books, community resources, all phases of audio-visuals, etc. Presented to elementary and secondary teachers as well as librarians to help them give more effective services.

235. **ORGANIZATION AND ADMINISTRATION OF THE INSTRUCTIONAL MATERIALS CENTER IN THE ELEMENTARY SCHOOL.** II. 3 hr. PR: Lib. Sci. 223 for teacher-librarians. Organization and administration of instructional materials center, including planning quarters, selection, acquisition, and organization of books and other materials, supervision of library assistants, relations with faculty, administration and community.

304. ADVANCED CATALOGING AND CLASSIFICATION. II, S. 3 hr. PR: Lib. Sci. 223.

309. SEMINAR. I or II, S. 3 hr. Required of all majors in Library Science.

310. SPECIAL TOPICS. 3 hr. PR: Lib. Sci. 309. A thorough study of some phase of library science based on the needs and interest of the individual.

311. PROBLEM REPORT. (Ed. 360). 3 hr. PR. 6 hours of Education courses, Lib. Sci. 309.

<i>Required Courses In Education</i>	6 Hr.
Ed. 221—Audio-visual Resources in Education	3
Ed. 360—Problem in Education (Library Science)	3
<i>Electives From This Group</i>	6 Hr.
Ed. 271—Educational Measurements	3
Ed. 322—Organizing Programs of Audio-visual Instruction	2
Ed. 331—Philosophy of Education	3
Ed. 335—Elementary School Curriculum	3
Ed. 336—Secondary School Curriculum	3
Ed. 339—Public-school Organization and Administration	3
Ed. 348—Human Development and Behavior	3
Ed. 385—History of Education	3
C&G 373—Basic Course in Guidance	3

MATHEMATICS

Graduate students in mathematics must pass a qualifying examination before becoming candidates for the Master's degree. This examination is held in October, February, and June. Its purpose is to check on the student's undergraduate background and test his fitness to pursue graduate work in the Department. A student is not eligible to take his final oral examination the same semester (or summer) he passes his qualifying examination.

The Department of Mathematics offers two Master's degrees, the A.M. and the M.S. The A.M. degree is intended for those who expect to continue the study of mathematics at the doctoral level and the requirements have been set up accordingly. The M.S. degree is planned as a terminal degree and should suit the requirements of those students who expect to enter industrial work, research laboratories, statistics, teaching, computer centers, actuarial analysis, and other situations requiring special mathematics training beyond that included in the undergraduate major.

DEPARTMENTAL REQUIREMENTS

(a) The A.M. degree (preparation for doctoral work in mathematics).

A minimum of 30 hours credit is required for the A.M. degree. At least twenty-four hours of this minimum must be in the "300" series of mathematics courses; six hours in each of three of the following fields: algebra, analysis, geometry, topology. No more than six hours of "200" level courses in mathematics may be credited towards the A.M. degree. A thesis is optional.

(b) The M.S. degree (training other than predoctoral).

A minimum of 30 hours credit is required for the M.S. degree. At least 21 hours of this minimum must be in the "300" series of mathematics courses.

The program of mathematics courses will be worked out in conference with the Chairman of the Graduate Committee of the Department of Mathematics.

Students lacking the prerequisites in the "200" level courses will find it necessary to take these courses in addition to their graduate program.

MATHEMATICS

201, 202. COMBINATORIAL ANALYSIS. I, II. 3 hr. PR: One year of calculus. Permutations, combinations, generating functions, principle of inclusion and exclusion, distributions, partitions, compositions, trees, and networks.

206. MATHEMATICAL LOGIC 2. I or II. 3 hr. PR: Math. 106. Formalization of the material in the previous term, the concepts of consistency, decidability, and completeness (equivalent to Philosophy 206).

208, 209. **THEORY OF PROBABILITY. I, II.** 3 hr. PR: Math. 17. Fundamental theorems. Development of density and distribution functions in the discrete and continuous cases. Classical problems and solutions. Moments, characteristics functions, limit theorems. Applications.

213. **INTERMEDIATE DIFFERENTIAL EQUATIONS. II.** 3 hr. PR: Math. 140, 252 (or 258). Second-order linear equations, Riccati equation, complex variables. Series solutions. Equations of Fuchsian type, hypergeometric equation, confluence of singularities. Classical equations, applications.

220, 221. **NUMERICAL ANALYSIS. I, II.** 3 hr. PR: Math. 17 and pre- or corequisite Math. 110 or I. E. 180, or consent. The composition, propagation and generation of error. The discrete finite difference calculus. Polynomial approximation including interpolation, numerical solution of differential equations, least squares, Chebyshev polynomials. Non-polynomial approximation. Numerical solution of equations and systems of equations. Eigenvalue problems, random numbers, and Monte Carlo methods.

230, 231. **THEORY OF NUMBERS. I, II.** 3 hr. PR: One year of calculus. Introduction to classical number theory, covering such topics as divisibility, the Euclidean algorithm, Diophantine equations, congruences, primitive roots, quadratic residues, number-theoretic functions, distribution of primes, irrationals, and combinatorial methods. Special numbers, such as those of Bernoulli, Euler, and Stirling.

232. **MATHEMATICAL STATISTICS. II.** 3 hr. PR: Math. 17. Discrete and continuous variables; correlation, regression, sampling theory; normal, chi-square, t, and F distributions; significance tests; analysis of variance.

235. **INTRODUCTION TO ANALYSIS AND TOPOLOGY. I, II.** 3 hr. PR: Math. 17 or consent. A study of sets, relations, functions; cardinal numbers, and orderings. Topological spaces including continuity, convergence, separation, compactness, and connectedness.

236. **INTRODUCTION TO ALGEBRAIC STRUCTURES. I, II.** 3 hr. PR: Math. 17 or consent. Basic study of groups, rings, integral domains, fields, and polynomial rings. Special consideration of the real and complex fields and related topics.

237. **INTRODUCTION TO LINEAR ALGEBRA. II.** 3 hr. PR: Math. 17 or consent. A study of vector spaces, matrices, determinants, linear transformations, linear programming, bilinear and quadratic forms, and related topics.

243. **PROJECTIVE GEOMETRY. II.** 3 hr. PR: Math. 236. Projective, affine, and metric geometries of the line, plane, and space; conics and quadrics.

245. **VECTOR ANALYSIS. I.** 3 hr. PR: Math. 140. Vector definitions and operations, differentiation, the operator del, integration, generalized coordinates, irrational solenoidal vectors, electrostatic fields, potentials.

247. **THEORY OF NUMBERS. S.** 3 hr. PR: Math. 17. Divisibility, distribution of primes, theory of congruences, theory of quadratic residues, arithmetical properties of the roots of unity. Diophantine equations, and the prime number theorem.

251, 252. **ADVANCE CALCULUS. I, II.** 3 hr. PR: Math. 235 or consent. A study of sequences, limits, continuity, definite integral convergence, differentiation, differentials, functional dependence, multiple integrals, line and surface integrals, and differential forms.

256. **INTRODUCTION TO COMPLEX VARIABLES. II.** 3 hr. PR: Math. 258 or 260 or 252. Introductory course primarily for students in engineering and physics. Elementary principles, conformal mapping, and applications.

257. **APPLIED MATHEMATICS. I.** 3 hr. PR: Math. 140. Primarily for Engineers and Scientists. Elements of function theory. Differential and integral calculus. Space geometry. Line, surface and multiple integrals, Infinite Series. Complex variables and applications.

258. APPLIED MATHEMATICS. II. 3 hr. PR: Math. 257. Primarily for Engineers and Scientists. Linear equations. Transformations and quadratic forms. Vector and tensor analysis. Orthonormal functions. Integral equations. Variational methods. Elements of probability.

259. INTRODUCTION TO THE LAPLACE TRANSFORM. II. 3 hr. PR: Math. 140. Introduction at the undergraduate level to the theory and application of the Laplace transform.

260. ADVANCED REAL CALCULUS. S. 3 hr. PR: Math. 17. Limits, series, metric spaces. Uniformity. Integrals.

261, 262. SPECIAL TOPICS. S. 2-4 hr. PR: Math. 17 or consent. Primarily for secondary school teachers. Topics in modern mathematics. Content may vary with the needs of the students.

263. SPECIAL TOPICS. II. 2-3 hr. PR: Math. 262 or consent. Sets and relations; axiomatization of a mathematical system; algebraic structure; real number system; and critical study of the foundations of Euclidean geometry.

264, 265. FOUNDATIONS IN ALGEBRA. S. 2 hr. PR: Differential and integral calculus, or consent. Not open to students with credit for Math. 236. Introduction to algebraic structures: rings, the integral domain of integers, properties of the integers, fields, polynomials over a field, groups; matrices; linear systems; vector spaces; vector geometry; linear transformations; and linear programming.

266, 267. FOUNDATIONS OF GEOMETRY. S. 2 hr. PR: Differential and integral calculus, or consent. A study of affine, projective, Euclidean and non-Euclidean geometries.

268, 269. PROBABILITY AND STATISTICS. S. 2 hr. PR: Differential and integral calculus or consent. Finite sample space, measure of the set of outcomes and probability of events, independent trials, functions on the sample space, approximations to the binomial distribution, elementary statistical inference, continuous sample space, limit theorems. Stochastic processes, statistical models, and applications.

270, 271. INTRODUCTION TO MATHEMATICS FOR THE ELEMENTARY TEACHER. I, II. 3 hr PR: Math. 6 or consent. Systems of numeration; sets, relations, binary operations, decimal and other base systems; natural numbers, integers, rational numbers, and real numbers with emphasis on the algebraic structure of each; the notions of length, area and volume; Pythagorean theorem; coordinate geometry.

280. INTRODUCTION TO METAMATHEMATICS 1. I. 3 hr. PR: Consent. Survey of the methodology of the deductive sciences with emphasis on the theory of proof and effective operations therein. (Equivalent to Philosophy 280).

281. INTRODUCTION TO METAMATHEMATICS 2. II. 3 hr. PR: Math. 280. This course deals with recursive function theory. Godel's proof and associated results. (Equivalent to Philosophy 281).

299. SEMINAR IN APPLIED MATHEMATICS. I, II. 1-12 hr.

309. GROUP THEORY. II. 3 hr. PR: Math. 236 or consent. Order, index, coset, normal subgroup, factor group, homomorphism; direct product; fundamental theorem of Abelian groups; endomorphism and automorphism; groups with operators; normal series; the Jordan-Holder theorem.

311, 312. INTRODUCTORY TOPOLOGY. I, II. 3 hr. PR: Math. 252 or consent. An axiomatic treatment of topological spaces including metric spaces. A detailed study of convergence, connectivity, continuity, and related topics.

314. TENSOR ANALYSIS. II. 3 hr. PR: Math. 245, 252, (or 258). Vector concept developed from standpoint of algebraic invariants, surface geometry, tensor operators, curvature tensor. Ricci and Pianchi identities, applications of tensors to physical phenomena.

315. CALCULUS OF VARIATIONS. II. 3 hr. PR: Math. 140, 252 (or 258). Maximum and minimum value of an integral, shortest distance, the brachistochrone problem, surface of revolution of minimum area, conditions for a relative minimum. Applications.

320, 321. SPECIAL FUNCTIONS. I, II. 3 hr. PR: Math. 140, 252. Operational techniques; generalized hypergeometric functions; classical polynomials of Bell, Hermite, Legendre, Noerlund, etc. Introduction to recent Polynomial systems. Current research topics.

322, 323. ANALYTIC NUMBER THEORY. I, II. 3 hr. PR: Math. 230-231, 236-365. Selected topics in analytic number theory such as the prime number theorem; primes in an arithmetical progression; the Zeta function; the Goldbach conjecture.

331, 332. THEORY OF PARTIAL DIFFERENTIAL EQUATIONS. I, II. 3 hr. PR: Math. 252, or equivalent. Elementary concepts; Cauchy problems; the Cauchy-Kowalewski theorem; general existence theorems; associated surfaces; classification into elliptic, parabolic, and hyperbolic types; conditions required of coefficients for solvability; techniques for solution; distribution theory; and numerical methods.

351, 352. ALGEBRAIC GEOMETRY. I, II. 3 hr. PR: Math. 243, 236. Foundations of affine geometry, the geometry of quadratic forms. Structure of the general linear group, symplectic groups, and orthogonal groups.

353. LINEAR ALGEBRA. II. 3 hr. PR: Math. 237 or consent. Review of theory of groups and fields; linear vector spaces including the theory of duality; full linear group; bilinear and quadratic forms; and theory of isotropic and totally isotropic spaces.

354, 355. ALGEBRAIC THEORY OF SEMIGROUPS. 3 hr. PR: Math. 362-363, or equivalent. Ideal theory, matrix representation of semigroups, decompositions and extensions, simple semigroups, inverse semigroups, congruence relations, recent research.

357. FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS. I. 3 hr. PR: Math. 140, 252 (or 258). Partial differential equations of physics, orthogonal sets; the generalized Fourier series; Fourier series and their properties; Fourier integrals; boundary value problems; Bessel functions and Legendre polynomials; uniqueness of solutions.

358. OPERATIONAL METHODS IN PARTIAL DIFFERENTIAL EQUATIONS. II. 3 hr. PR: Math. 140, 252 (or 258). Laplace transformation, properties and elementary applications; problems in partial differential equations; complex variable; problems in heat conduction, mechanical vibrations, etc. Sturm-Liouville systems. Fourier transforms.

360, 361. DIFFERENTIAL GEOMETRY. I, II. PR: Math. 236, 243. Elementary differential geometry. Transformation groups. Space curves. Surfaces. Geometry of surfaces.

362, 363. INTRODUCTION TO MODERN ALGEBRA. I, II. 3 hr. PR: Math. 236, or consent. Concepts from set theory and the equivalence of the Axiom of Choice. Zorn's Lemma, and the Well-Ordering Theorem; a study of the structure of groups, rings, fields, and vector spaces; elementary factorization theory; extensions of ring and fields; modules and ideals; and lattices.

364, 365. THEORY OF FUNCTIONS OF COMPLEX VARIABLES. I, II. 3 hr. PR: Math. 252. Number systems; the complex plane; fractions, powers and roots, holomorphic functions; power series; elementary functions; complex integration. Representation theorems. Calculus of residues; analytic continuation; algebraic and elliptic functions. Conformal mapping.

366, 367. ALGEBRAIC PLANE CURVES. I, II. 3 hr. PR: Math. 243. General theory of curves, singularities, associated curves.

376, 377. THEORY OF FUNCTIONS OF REAL VARIABLES. I, II. 3 hr. PR: Math. 235, 236, 252. Measure. Integration. Topics from functional analysis.

380. THESIS. I, II. 1-6 hr.

390. SEMINAR IN ANALYSIS. I, II. 1-12 hr.

391. SEMINAR IN ALGEBRA. I, II. 1-12 hr.

392. SEMINAR IN GEOMETRY. I, II. 1-12 hr.

393. SEMINAR IN NUMBER THEORY. I, II. 1-12 hr.

394. SEMINAR IN SPECIAL FUNCTIONS. I, II. 1-12 hr.

395. SEMINAR IN TOPOLOGY. I, II. 1-12 hr.

397. RESEARCH. 1-15 hr. PR: Consent. The student will be assigned to a member of the staff engaged in research to assist with the investigation of a significant problem. The work of the course will be that assigned to him by the staff member. The student may enroll for research under this course number any number of times approved by his adviser and the Dean of the Graduate School.

ASTRONOMY

216. ASTRONOMY FOR TEACHERS. S. 3 hr. Introduction to astronomy with special emphasis on the needs of physical science teachers and science club directors. Not open to students with credit for Astronomy 106.

255. MATHEMATICAL ASTRONOMY. II. 3 hr. PR: Astron. 106, Math. 140. Development of the implications of Kepler's Laws and Newton's Law of Gravitation.

STATISTICS

201. INTERMEDIATE STATISTICAL METHODS. II. 3 hr. PR: Stat. 101. Extension of basic concepts of statistical models, elementary decision theory, estimation, random variables, one- and two-way classification models, analysis of variance, F-distribution, time series, seasonal and cyclical movements, simple and multiple linear regression and correlation analysis (equiv. to Econ. 256).

211. STATISTICAL METHODS 1. I, II. 3 hr. PR: Math. 3. Basic concepts of statistical models, distributions, probability, random variables, tests of hypotheses, confidence intervals, regression, correlation, transformations, F and X^2 distributions, analysis of variance for one- and two-way classification models, multiple range tests, missing plots, and sample size (equiv. to Psychol. 211; and Ed. 211.)

212. STATISTICAL METHODS 2. I, II. 3 hr. PR: Stat. 211, Stat. 213 or Stat. 201. Extension of basic concepts of statistical models, design of experiments, multi-way classification models, factorials, split plot design, simple covariance, orthogonal comparisons, multiple linear and nonlinear regression and correlation analysis, chi-square, and non-parametric statistics (equiv. to Psychol. 215.)

213. BASIC STATISTICAL ANALYSIS 1. I, II. 3 hr. PR: Math. 16. Measures of central tendency and variation, probability, sampling, probability distributions, inference, tests of hypotheses, confidence intervals analysis of variance, simple linear regression and correlation, and enumeration statistics (equiv. to I.E. 244.)

214. BASIC STATISTICAL ANALYSIS 2. I, II. 3 hr. PR: Stat. 213 or equiv. Single and multi-factor experimental designs; fixed, mixed and random effect models; split plot designs; multilinear and nonlinear regression and correlation analyses; and analysis of covariance (equiv. to I.E. 214.)

221. DESIGN OF EXPERIMENTS. I. 3 hr. PR: Stat. 212 or Stat. 214. Extension of basic concepts of statistics to the more complicated models and use of samples, design and analysis of experiments over time and space, fractional replications, incomplete block design, cross-over designs, lattice designs, and least squares analysis for designs with unequal subclass numbers.

231. SAMPLING METHODS. I. 3 hr. PR: An introductory course in statistics. Methods of sampling from finite and infinite populations, choice of sampling unit, sample survey design, estimation of confidence limits and optimum sample size, and single and multi-stage sampling procedures.

233. **NONPARAMETRIC STATISTICS. II.** 3 hr. PR: An introductory course in statistics Single sample tests; for related samples, two independent samples, k related samples, k independent samples; and measures of correlation.

241. **MULTIVARIATE METHODS 1.** I. 3 hr. PR: Stat. 201, Stat. 211, or Stat. 213. Introduction to elementary matrix operations, partial and multiple linear and non-linear correlation and regression analyses, and introduction to discriminant analysis (equiv. to Psych. 217.)

242. **MULTIVARIATE METHODS 2.** II. 3 hr. PR: Stat. 241 or equiv. This course includes a discussion of the multivariate normal distribution, tests of hypotheses about the sample mean vectors and variance-covariance matrices from a multivariate normal distribution, and analysis of variance of multiple responses in basic statistical designs.

261. **THEORY OF STATISTICS 1.** I. 3 hr. PR: Math. 17. Probability and random variables, univariate and multivariate probability distributions, expectations, moment, marginal and conditional distributions, independence, correlation, transformations, and functions of random variables.

262. **THEORY OF STATISTICS 2.** II. 3 hr. PR: Stat. 261. Estimation including bias, consistency, efficiency and sufficiency, hypothesis testing, distribution-free problems, order statistics, linear models and analysis of variance and special distributions.

291. **SPECIAL TOPICS. I, II, S.** 2-4 hr. Advanced study of special topics in statistics.

346. **FACTOR ANALYSIS.** II. 3 hr. PR: Stat. 241. Alternative methods for factor extraction, communalities, rotation in orthogonal and oblique space, and estimation of factor scores (equiv. to Psychol. 318).

361. **LINEAR STATISTICAL MODELS 1.** I. 3 hr. PR: Stat. 214 or equiv. and Stat. 262 or consent. Statistical concepts, multivariate normal distribution, distribution of quadratic forms, linear models, general linear hypothesis, polynomial models, functional relationships and regression models (equiv. to I.E. 345).

362. **LINEAR STATISTICAL MODELS 2.** II. 3 hr. PR: Stat. 361. Experimental design models, factorial models, incomplete block models, assumptions of experimental design models, and components of variance for fixed, random, and mixed models (equiv. to I.E. 346).

PHILOSOPHY

ADMISSION

Acceptance of a student will be based on (1) a Bachelor of Arts Degree with a minimum grade-point average of 3.0; (2) adequate academic aptitude as measured by the Graduate Record Examination; and (3) references from persons who can attest to, and advise on, the applicant's ability to complete the degree program.

THE M.A. DEGREE

To obtain the Master of Arts degree in Philosophy, (1) a minimum of 30 semester hours of course work beyond the Bachelor's Degree is required; (2) a reading knowledge of some language, preferably French or German, is required; (3) a comprehensive examination in the areas of the History of Philosophy, Logic, Ethics and Theory of Knowledge must be passed; (4) a thesis must be submitted, or, at the discretion of the Department of Philosophy, a written examination in the candidate's special field must be passed; and (5) an oral examination must be passed.

A grade no lower than "B" in all courses taken at the graduate level is required.

PHILOSOPHY

206. **MATHEMATICAL LOGIC 2.** II. 3 hr. PR: Philos. 106 or consent. Formalization of the material in the previous term, the concepts of consistency, decidability, and completeness (equiv. to Math. 206).

214. **THEORY OF KNOWLEDGE.** I or II. 3 hr. PR: Philos. 106 and consent. Advanced topics in the theory of knowledge.

218. ETHICAL THEORY. I or II. 3 hr. PR: Philos. 108 or consent. Selected, complete ethical theories and/or special problems in meta-ethics.

221. CONTEMPORARY PHILOSOPHIES OF CONTINENTAL EUROPE. I or II. 3 hr. PR: Philos. 114. A study of the various European thinkers of the present day.

223. PHILOSOPHY OF RELIGION. I or II. 3 hr. PR: Philos. 123 or consent. Advanced topics in the philosophy of religion.

230. AESTHETIC THEORIES. I or II. 3 hr. PR: Philos. 130 or consent.

241. INTRODUCTION TO ANALYTIC PHILOSOPHY. I or II. 3 hr. PR: Philos. 102, 106. Contemporary schools of analytic philosophy.

250. SOCIAL AND POLITICAL PHILOSOPHY. I or II. 3 hr. PR: Philos. 150. Advanced topics in social and political philosophy.

253. PHILOSOPHY OF MATHEMATICS. I or II. 3 hr. PR: Philos. 106 or consent. Contemporary viewpoints in the foundations of mathematics.

258. PHILOSOPHY OF SCIENCE I. I or II. 3 hr. PR: Philos. 106 or consent. An analysis of the conceptual and methodological foundations of science.

259. PHILOSOPHY OF SCIENCE II. I or II. 3 hr. PR: Philos. 258 and Philos. 106 or consent. Further topics including induction, confirmation and cognitive status of scientific theories.

264. EMPIRICISM. I or II. 3 hr. PR: Philos. 101, 102. Locke, Berkeley, and Hume.

266. METAPHYSICS. I or II. 3 hr. PR: Philos. 166 or consent. Advanced topics in metaphysics.

268. RATIONALISM. I or II. 3 hr. PR: Philos. 101, 102. Descartes, Spinoza, and Leibniz.

270. GREEK PHILOSOPHY. I or II. 3 hr. PR: Philos. 101 and Philos. 102 or consent.

272. PHILOSOPHY OF LAW. I or II. 3 hr. PR: Philos. 108 or Philos. 150. Selected topics in foundations and procedures of law.

278. MEDIEVAL PHILOSOPHY. I or II. 3 hr. PR: Philos. 101, 102. A study of the major philosophies of the western world from Plotinus to Descartes.

280. INTRODUCTION TO METAMATHEMATICS I. I or II. 3 hr. PR: Consent. Survey of the methodology of the deductive sciences with emphasis on the theory of proof and effective operations therein (equiv. to Math. 280).

281. INTRODUCTION TO METAMATHEMATICS II. I or II. 3 hr. PR: Philos. 280. This course deals with recursive function theory. Godel's proof and associated results (equiv. to Math. 281).

283. PHILOSOPHY OF HISTORY. I or II. 3 hr. Typical theoretical problems such as the nature of historical explanation, relativism, and the status of speculative principles of history.

285. PHILOSOPHY OF LANGUAGE. I or II. 3 hr. PR: Philos. 106 or Philos. 104. An analysis of the nature of meaning and language.

287. PHILOSOPHY OF MIND I or II. 3 hr. PR: Philos. 241 or Philos. 114, or consent. Typical problems in this course have to do with whether there are minds, the difference between minds and bodies, other minds, and the analysis of mental concepts.

289. ADVANCED TOPICS IN LOGIC. I or II. 3 hr. PR: Philos. 206 or Philos. 280.

290. SEMINAR: SELECTED TOPIC. I or II. 3 hr. PR: Consent.

291. SEMINAR: SELECTED TOPIC. I or II. 3 hr. PR: Consent.

292. SEMINAR: SELECTED AUTHOR. I or II. 3 hr. PR: Consent.

- 293. SEMINAR: SELECTED AUTHOR. I or II. 3 hr. PR: Consent.
- 299. PHILOSOPHICAL QUESTIONS. I or II. 1-12 hr. PR: Consent.
- *301. INDUCTION AND RATIONAL BELIEF. I or II. 3 hr.
- 302. PHILOSOPHY OF SCIENCE. I or II. 3 hr.
- 303. THEORY OF KNOWLEDGE. I or II. 3 hr.
- 304. SYMBOLIC LOGIC. I or II. 3 hr.
- 305. HISTORY OF PHILOSOPHY. I or II. 3 hr.
- 306. METAPHYSICS. I or II. 3 hr.
- 307. SEMINAR 1. 3 hr.
- 308. SEMINAR IN THE PHILOSOPHICAL FOUNDATIONS OF LOGIC. 3 hr.
- 309. PROBLEMS IN PHILOSOPHY. I or II. 3 hr.
- 310. ETHICS. I or II. 3 hr.
- 311. PHILOSOPHICAL FOUNDATIONS OF PSYCHOLOGY. I or II. 3 hr.
- 312. THESIS. 2-6 hr.
- 316. FOUNDATIONS OF SET THEORY. I or II. 3 hr.

*All courses in the 300 series require departmental consent for admission.

PHYSICS

A candidate for the degree of Master of Science in Physics should have had introductory work in mechanics, electricity, and modern physics as acquired in undergraduate courses in physics or in related sciences at an approved college or university. Physics Seminar and research leading to a thesis are required. The remaining credit to make a minimum total of 30 semester hours is chosen from the graduate course in physics, mathematics, and other suitable sciences as approved by the student's adviser.

Applicants for the degree of Doctor of Philosophy will be required to pass a preliminary qualifying examination after one year of graduate work, to demonstrate reading proficiency in two language (French, German, or Russian), to complete a minimum of 42 hours of specified course work, to gain approval of his dissertation, and to pass a final oral examination.

PHYSICS

- 201, 202, 203, 204. SPECIAL TOPICS. I, II. 1-3 hr. per sem.
- 213. INTRODUCTORY ELECTRONICS. S. 3 hr. PR: 1 year college physics. Primarily for education majors; not for graduate credit for science majors.
- 218. DYNAMIC METEOROLOGY. II. 3 hr. PR: Physics 117 or equiv. and calculus. Dynamics of lower atmosphere relating to transport and dispersion of foreign matter.
- 221. OPTICS. II. 3 hr. PR: Calculus, Physics 11, 102, or equiv. Work with optical instruments, spectrometry, interferometry, and polarization.
- 225, 226. MODERN PHYSICS. I, II. 3 hr. per sem. PR: Calculus, Physics 11, 102, or equiv. Particle analysis, phenomena connected with the structure of the atom, and nucleus. Not open to those who have credit for Physics 125 and 126.
- 231, 232. THEORETICAL MECHANICS. I, II. 3 hr. per sem. PR: Calculus, Physics 11, 102, or equiv. Theorems and problems in intermediate mechanics.
- 233, 234. INTRODUCTORY ELECTRICITY AND MAGNETISM. I, II. 3 hr. per sem. PR: Calculus, Physics 11, 102, or equiv. Electrostatics, magnetostatics, introductory electrodynamics, and applications.

241, 242. MECHANICS LABORATORY. I, II. 1 hr. To supplement Physics 231, 232.

243, 244. ELECTRICITY LABORATORY. I, II. 1 hr. To supplement Physics 233, 234.

245, 246. MODERN PHYSICS LABORATORY. I, II. 1 hr. To supplement Physics 225, 226.

247, 248. PHYSICS SEMINAR. I, II. No credit. Required of Junior, Senior, and Graduate physics majors.

249. OPTICS LABORATORY. II. 1 hr. To supplement Physics 221.

254. OUTLINE OF MODERN PHYSICS. S. 3 hr. PR: 1 year of college physics, 1 year of college mathematics. Selected topics in modern physics. Primarily for education majors; not open to physics majors.

255, 256. WORKSHOP FOR PHYSICS TEACHERS. SI, SII. 3 hr. PR: 1 year of college physics, 1 year of college mathematics. Techniques of apparatus construction and demonstration. Primarily for education majors; not open to physics majors.

257. PHOTOGRAPHY. SI. 3 hr. PR: 1 year of physics or equiv. Primarily for education majors; not open to physics majors.

258. LIGHT. SII. 3 hr. PR: 1 year of physics or equiv. Primarily for education majors; not open to physics majors.

261, 262. MOLECULAR PHYSICS. I, II. 3 hr. per sem. PR: Physics 225, 226. Molecular spectra and molecular structure.

271, 272. SOLID STATE PHYSICS. I, II. 3 hr. per sem. PR: Physics 225, 226. Theoretical concepts required for the understanding of the physical properties of simple crystalline solids.

283. THERMODYNAMICS. I. 3 hr. PR: Calculus, Physics 11, 102, or equiv. Application of fundamental laws of thermodynamics to physical systems.

284. KINETIC THEORY. II. 3 hr. PR: Calculus, Physics 11, 102, or equiv. Application of Boltzmann statistics to physical systems.

287, 288. INTRODUCTION TO MATHEMATICAL PHYSICS. I, II. 3 hr. per sem. PR: Calculus, Physics 11, 102, or equiv. Boundary value problems in vibration, heat conduction, hydrodynamics, special relativity.

325, 326. ATOMIC AND MOLECULAR PHYSICS. I, II. 3 hr. PR: Physics 225, 226 or equiv. Treatment of these aspects of modern physics at a level beyond and in more detail than that of intermediate modern physics.

331, 332. ADVANCED CLASSICAL MECHANICS. I, II. 3 hr. PR: Calculus, Physics 231, 232. Lagrangian and Hamiltonian formulations of mechanics, Hamilton-Jacobi theory, small oscillations.

333, 334. ADVANCED ELECTRICITY AND MAGNETISM. I, II. 3 hr. PR: Physics 233, 234, and differential equations. Wave propagation, electrodynamics of charged particles.

341, 342. RESEARCH SEMINAR. I, II. 3 hr. PR: Consent. Discussion of problems encountered in particular fields of research, and their relation to other areas of physics.

351, 352. QUANTUM MECHANICS. I, II. 3 hr. per sem. PR: Physics 225, 226. Schrödinger's equations, hydrogen atom, perturbation, molecular forces.

353. ADVANCED QUANTUM MECHANICS. I. 3 hr. PR: Physics 351, 352. Study of relativistic theory, many electron systems, introduction to quantum electrodynamics.

360. NUCLEAR PHYSICS. I. 3 hr. PR: Physics 225, 226. Outline of modern treatment of nuclear theory and experimental techniques.

363, 364. ADVANCED NUCLEAR PHYSICS. I, II. 3 hr. per sem. PR: Physics 225, 226. Theory of nuclear forces, transformation, energy levels.

371, 372. ADVANCED SOLID STATE PHYSICS. I, II. 3 hr. per sem. PR: Physics 271, 272, 351. Detailed discussion and quantum treatment of topics of solid state physics.

383. STATISTICAL MECHANICS. II. 3 hr. per sem. PR: Physics 283, 352. Classical statistics, Boltzman, F-D, and B-E statistics, theory of fluctuations.

397, 398. RESEARCH. I, II. 1-6 hr. per sem. PR: Consent.

POLITICAL SCIENCE

The graduate program in political science at West Virginia University extends through the Doctor of Philosophy degree. With reference to departmental objectives, the emphasis is placed upon more extensive and intensive training than is possible on the undergraduate level. This involves: (1) the development of a broader knowledge of the literature of political science; (2) some degree of specialization in one of the major areas of the disciplines; and (3) training in the identification and analysis of problems in governmental theory and practice. Graduate work in political science contributes to a general education and provides the foundation for more advanced work in the field. Leading professional possibilities for political science majors include teaching, the public service, and preparation for the legal profession.

THE DEGREE OF MASTER OF ARTS

Eligibility. Regular applicants for the Master of Arts degree should present a minimum of 12 semester hours of undergraduate credit in political science and at least 6 additional hours in some cognate field, including history, economics, sociology, psychology, philosophy, or social work. Students who do not meet the minimum requirements may, after consultation with the adviser, be admitted conditionally. In addition, a grade-point average of 2.5 should have been maintained as an undergraduate.

"Special" graduate students who are not working for an advanced degree may be admitted to courses for which they can satisfy the prerequisites.

Course Requirements. Admission to candidacy for the Master of Arts degree in political science is conditioned upon the completion of at least 30 hours of graduate work including a thesis. The candidate should present 18 semester hours of graduate course work in political science and 6 hours of similar work in a cognate field, such as economics, history, sociology, philosophy, psychology, social work or education. Exceptions to this general rule may be made by the departmental adviser in the case of students with an inadequate background in political science who transfer from other institutions or from other departments in West Virginia University. Normally the thesis will carry 6 hours credit. A reading knowledge of a foreign language is highly desirable.

Thesis and Final Examinations. In his graduate program, the student will write a thesis on a subject falling within his field of specialization. Fulfillment of the thesis requirement includes the following steps: (1) selection of a problem or topic for research in the problem area; (2) extensive reading and collection of data in the problem area; (3) organization, analysis, and evaluation of the data; (4) writing the thesis in correct form; (5) acceptance of the completed thesis by a committee composed of at least three faculty members, one of whom shall not be a member of the Department of Political Science, and (6) passing an oral or written examination or both, administered by the committee on the thesis and the major and minor fields.

Research on the thesis project will be done under the supervision of a staff member in whose field of specialization the thesis problem falls.

Students who fail to pass the final examination may appear for a second examination not earlier than the semester following that in which the first examination was given. It is contrary to departmental policy to give a third examination.

THE DEGREE OF DOCTOR OF PHILOSOPHY

To gain admission to the program leading to the Doctor of Philosophy degree applicants must have completed the requirements for a master's degree, or the equivalent, at an approved institution as well as have demonstrated a capacity for graduate work in the Graduate Record Examination.

The program of courses will depend upon the individual needs of the student and the extent of his previous training in political science and related fields. Work leading to the doctoral degree consists of a minimum of three full years of graduate

study—at least 60 semester hours after the bachelor's degree, in addition to research for the dissertation. Credits completed for a master's degree may be included in the doctoral program, with the exception of research credit granted for the master's thesis. Only credits with a grade of B or better in political science courses and C or better in the minor are accepted. A minimum of 36 hours or its equivalent in residence in full-time graduate study at West Virginia University is required.

With the approval of his adviser, a prospective candidate selects: (A) four major areas in the field of Political Science from the following six offered by the Department: (1) American National, State and Local Government; (2) Politics and Policy Development; (3) Public Administration; (4) Foreign and Comparative Government; (5) International Relations, Organizations, and Law; and (6) Political Theory; and (B) a minor area in a related field. At least one year prior to the conferring of the degree and after maintaining at least a 3.0 average in the major field and a 2.0 average in the minor, a prospective candidate is formally admitted to candidacy for the Doctor's degree upon satisfactorily passing written and oral examinations in the four major areas and the minor. To be eligible for these examinations, the prospective candidate must have demonstrated competency in two languages other than English (normally French and German) through examinations conducted by the language department.

Upon admission to candidacy for the Doctor of Philosophy degree, the candidate must select a topic for a dissertation under the direction of his adviser, complete a dissertation which makes a contribution to knowledge in the candidate's area of concentration, and pass a final examination based primarily upon the dissertation. After successful completion of this final examination, the candidate will be recommended for the degree.

POLITICAL SCIENCE

200. RESEARCH MATERIALS AND TECHNIQUES IN POLITICAL SCIENCE. I. 3 hr. A study of basic source materials in political science and of the techniques and methods of governmental research. Required of graduate majors.
210. AMERICAN POLITICAL INSTITUTIONS. I. 3 hr. PR: Pol. Sci. 2 or consent. Development of the Constitution, Congress, the Presidency, and the Supreme Court as institutions with special attention to current problems and issues.
211. PROBLEMS OF AMERICAN NATIONAL GOVERNMENT. II. 3 hr. PR: Pol. Sci. 2 or consent. This course is intended to give recognition to the major contemporary problems of government. Extensive reading of background materials as well as current literature in the field.
213. AMERICAN CONSTITUTIONAL LAW. I. 3 hr. PR: Pol. Sci. 2 or consent. Basic principles of American constitutional law as developed through interpretation with special emphasis on constitutional theories and national development. Primarily for seniors and graduate students.
214. CIVIL RIGHTS AND LIBERTIES IN THE UNITED STATES. II. 3 hr. PR: Pol. Sci. 213 or consent. Study of the scope and meaning of civil liberty guarantees in the United States Constitution, as illustrated by cases involving original constitutional provisions, the federal Bill of Rights and Civil War Amendments with special attention to the rule of law; free speech, press, religion, assembly, and petition; personal security; racial discrimination; and the labor problem.
215. AMERICAN CONSTITUTIONAL DEVELOPMENT I. I. 3 hr. PR: Pol. Sci. 2 or consent. A survey of American constitutional development, with special emphasis on the origins of constitutionalism here; liberty vs. government; mixed government; separation of powers; the problem of federalism and the Philadelphia Convention of 1787; the Marshall court and establishment of judicial review; Federalist vs. States Rights construction of the Constitution; Jacksonian influences; the Taney Court prelude to the Civil War, secession, and conflict, heralding constitutional change.
216. AMERICAN CONSTITUTIONAL DEVELOPMENT II. II. 3 hr. PR: Pol. Sci. 2, 215 or consent. Continuation of a survey in American constitutional development, with special attention to reconstruction, the Supreme Court, and the Fourteenth Amendment; *laissez-faire* and the commerce clause; stirrings of reform toward

a constitutional revolution under the New Deal; changing federal-state relationships; the impact of war upon constitutional interpretation; an expanding role for the president in domestic matters and foreign relations; the Warren court and triumph for libertarian activists over judicial restraintists in an era of civil liberties.

218. **GOVERNMENT AND BUSINESS.** I. 3 hr. PR: Pol. Sci. 2 or consent. An examination of government regulations of the economy dealing with the origin and development of public policies, constitutional and political basis of regulation, relationships between political and economic institutions and processes, and an evaluation of the consequences of regulatory policies.
221. **WEST VIRGINIA GOVERNMENT AND ADMINISTRATION.** I, II. 3 hr. A study of the organization and operation of the state government of West Virginia.
225. **MUNICIPAL GOVERNMENT.** II. 3 hr. Legal basis, structure, operation, and problems of municipal government and municipal relations with other governmental units.
226. **PROBLEMS OF STATE AND LOCAL GOVERNMENT.** I. 3 hr. An examination of current problems of state, county, and municipal governments. Students are expected to have completed Pol. Sci. 120 or its equivalent.
231. **HISTORY OF POLITICAL PARTIES.** I. 3 hr. An examination of the growth of political parties in the United States. Analysis of issues in presidential campaigns as they relate to political party development. Offered in odd-numbered years.
232. **PUBLIC OPINION AND PROPAGANDA.** II. 3 hr. Analysis of techniques of sampling and measuring public opinion; detection of propaganda; the nature of propaganda and methods of the propagandist. Offered in alternate years.
233. **CURRENT POLITICAL ISSUES.** I. 3 hr. An examination of political party platforms and the major issues of the political campaign. Students will be expected to examine background materials thoroughly. Offered in even-numbered years.
234. **THE LEGISLATIVE PROCESS.** II. 3 hr. Structure and organization of legislative bodies. Powers of legislature. Detailed study of law-making procedures. The influence of outside forces. Offered in alternate years.
241. **ADMINISTRATIVE ORGANIZATION AND MANAGEMENT.** II. 3 hr. PR: Pol. Sci. 140 or consent. Analysis of governmental administrative organization and reorganization and of such management functions as leadership, planning, coordination, public relations, and management improvement. Offered in alternate years.
244. **ADMINISTRATIVE LAW AND REGULATIONS.** II. 3 hr. PR: Pol. Sci. 140 or consent. Study of the law of administration, primarily by the case method, covering administrative powers, procedure in administrative adjudication and rule-making, discretion, judicial control, and administrative liability. Offered in alternate years.
245. **PUBLIC ADMINISTRATION AND POLICY DEVELOPMENT.** I. 3 hr. PR: Pol. Sci. 140 or consent. Analysis of decision-making and policy development in the administrative process by the case method. Offered in alternate years.
246. **COMPARATIVE PUBLIC ADMINISTRATION.** II. 3 hr. A survey of the theory and practice of public administration in diverse cultures and national political systems.
250. **COMPARATIVE GOVERNMENT.** I. 3 hr. A comparative study of modern political institutions with particular attention to European constitutional government and politics.
251. **MODERN DICTATORSHIPS.** II. 3 hr. Politically undemocratic government. Provides background of dictatorships generally, followed by treatment of several modern dictatorships.
252. **BRITISH GOVERNMENT AND POLITICS.** II. 3 hr. Intensive study of British government with emphasis upon both internal and external policies, primarily during the twentieth century. Offered in alternate years.

253. **THE COMMONWEALTH OF NATIONS.** II. 3 hr. An analysis of the political relationships between the members of the Commonwealth and a comparative study of the governments of the Dominions with particular reference to Canada and Australia.

254. **GOVERNMENT OF ASIA.** I. 3 hr. A survey of contemporary politics and governments of Asia.

255. **GOVERNMENT OF LATIN AMERICA.** II. 3 hr. A comparative study of the major nations of Latin America.

256. **GOVERNMENTS OF THE MIDDLE EAST.** I. 3 hr. An examination of governments and political forces of the Middle East.

259. **POLITICAL TOUR OF EUROPE.** Summer. 6 hr. PR: Pol. Sci. 1 and 2 or consent. Selected important countries of Europe with lectures and discussion on the governments and politics of these countries. Attention is given to the European Common Market also. Includes interviews with party officials, legislators, civil servants, municipal officials, and newspapermen.

261. **INTERNATIONAL ORGANIZATION.** II. 3 hr. Emphasis will be placed upon agencies created since the close of World War II. Some reference to development of international law and League of Nations.

262. **SPECIALIZED AGENCIES OF THE UNITED NATIONS.** II. 3 hr. A detailed treatment of the specialized agencies and related institutions.

263. **PUBLIC INTERNATIONAL LAW.** I. 3 hr. Law governing relations among nations, including development of rules, means of enforcement, and conflicts between theory and practice.

264. **CONDUCT OF AMERICAN FOREIGN RELATIONS.** I. 3 hr. Basic concepts about and factors influencing the decision-making process and the conduct of United States foreign policy, with special attention to the problems of ends and means of a democracy, pressure interest groups (i.e., the military-industrial complex and the administrative bureaucracy); recent theories, analytical tools, and methodology in the problem areas of conflict-resolution, nonconsensus situations, and inter-nation influence; regional patterns, problems, and prospects of United States policy in Europe, Africa, Asia, the Middle East, and the Soviet bloc since 1945.

265. **BASIC FACTORS IN POWER POLITICS.** II. 3 hr. PR: Pol. Sci. 2 or consent. Analysis of factors of power in the nation-state system. Evaluation of nationalism and concepts of national interest in modern world politics.

266. **SOVIET FOREIGN POLICY.** I. 3 hr. PR: Pol. Sci. 150 or 160 or consent. Basic concepts about and factors influencing choice in the formulation and execution of Soviet foreign policy; the development and present patterns in Soviet foreign relations with key states and the United Nations; possible problems and prospects in future Soviet relations.

267. **LATIN AMERICA IN INTERNATIONAL AFFAIRS.** II. 3 hr. PR: Pol. Sci. 160 or 255 or consent. Survey of the relations of Latin American States among themselves, with the United States of America, with the United Nations, with regional organizations, and with non-Western States. Analysis in depth of the Monroe Doctrine and its corollaries, and the Inter-American system.

272. **RECENT AND CONTEMPORARY POLITICAL THOUGHT.** I. 3 hr. An examination of integral liberalism and the forces leading to the decline of liberalism and a critical analysis of the Fascist and Communist ideologies with their threat to the traditions of western civilization embodied in Christianity and conservatism.

273. **AMERICAN POLITICAL THEORY.** II. 3 hr. PR: Pol. Sci. 171 or consent. A survey of major political ideas and their influence upon American society and government from the seventeenth century to the present. Offered in alternate years.

274. **PROBLEMS IN CONTEMPORARY POLITICAL THOUGHT.** II. 3 hr. An intensive study of current trends in political thought through examination of the works of contemporary writers. Offered in alternate years.

300, 301. GENERAL SEMINAR IN POLITICAL SCIENCE. I, II. 1 hr. each. Open to properly qualified students in conjunction with Directed Reading and Research Courses for the presentation of papers for critical consideration; some attention will be given to methodology and bibliography.

310, 311. DIRECTED READING AND RESEARCH IN AMERICAN NATIONAL GOVERNMENT. I, II. 1-15 hr. per sem., students may enroll more than once.

314. SEMINAR IN AMERICAN NATIONAL GOVERNMENT. I. 3 hr. PR: Consent. Offered every fourth year.

320, 321. DIRECTED READING AND RESEARCH IN STATE GOVERNMENT. I, II. 1-15 hr. per sem., students may enroll more than once.

324. SEMINAR IN STATE AND LOCAL GOVERNMENT. I. 3 hr. PR: Consent. Offered every fourth year.

325, 326. DIRECTED READING AND RESEARCH IN LOCAL GOVERNMENT. I, II. 1-15 hr. per sem., students may enroll more than once. PR: Pol. Sci. 225 or consent.

330, 331. DIRECTED READING AND RESEARCH IN POLITICS. I, II. 1-15 hr. per sem., students may enroll more than once. PR: Pol. Sci. 130 or consent.

334. SEMINAR IN POLITICS AND POLICY DEVELOPMENT. I. 3 hr. PR: Consent. Offered every fourth year.

344. SEMINAR IN PUBLIC ADMINISTRATION. I. 3 hr. PR: Consent. Offered every fourth year.

346, 347. DIRECTED READING AND RESEARCH IN PUBLIC ADMINISTRATION. I, II. 1-15 hr. per sem., students may enroll more than once. PR: Pol. Sci. 140 or consent.

351, 352. DIRECTED READING AND RESEARCH IN COMPARATIVE GOVERNMENT. I, II. 1-15 hr. per sem., students may enroll more than once.

354. SEMINAR IN COMPARATIVE GOVERNMENT. II. 3 hr. PR: Consent. Offered every third year.

361, 262. DIRECTED READING AND RESEARCH IN INTERNATIONAL RELATIONS. I, II. 1-15 hr. per sem., students may enroll more than once.

364. SEMINAR IN INTERNATIONAL RELATIONS. II. 3 hr. PR: Consent. Offered every third year.

374. SEMINAR IN POLITICAL THEORY. II. 3 hr. PR: Consent. Offered every third year.

375, 376. DIRECTED READING AND RESEARCH IN POLITICAL THEORY. I, II. 1-15 hr. per sem. Students may enroll more than once.

380. THESIS. I, II. 2-15 hr.

PSYCHOLOGY

Admission. Acceptance of the student will be based on: (1) adequate academic aptitude at the graduate level as measured by the Graduate Record Examination; (2) a minimum average grade of 2.5 (C+); (3) personal qualities in the applicant which are predictive of success in graduate study and satisfactory professional placement after graduation; (4) adequate preparation in the biological and social sciences, experimental psychology, and statistics. By permission, deficiencies in preparation may be made up after admission to the department. Students are expected to maintain a 3.0 (B) average in their psychology courses during the first graduate year, and to present a final 3.0 average in all psychology courses attempted.

The M.A. Degree. Two alternative programs leading to the Master's degree are offered.

Thesis option: This requires a minimum of 30 graduate credits and presentation of a thesis reporting the results of experimental research. Competence in basic areas of psychology is stressed; however, the student may specialize to a limited extent in the technology of clinical or industrial psychology. This option must be elected by those who plan to apply for the Ph.D. program.

Non-thesis option in clinical psychology. This requires a minimum of 48 graduate credits in specified courses, providing more intensive and specialized training for professional service than does the thesis option. Students completing this option will not be recommended for continuation to the Ph.D. degree. Each of the Master's programs requires the student to demonstrate competence in basic areas of psychology after one year of full-time graduate study, and to pass an oral examination over his specialty area and related matters at the end of his course.

The Ph.D. Degree. The doctoral programs aim to prepare a small number of well-qualified psychologists for three types of careers: (1) the teaching of general psychology; (2) teaching and research in life-span developmental psychology, and (3) clinical services in institutions, clinics, or schools. The clinical program requires a 12-months internship in an approved setting. The career teacher program requires an academic year of supervised college teaching.

Students are admitted to doctoral study only after completion of the Master's degree or its equivalent and shall be subject to a screening examination to determine their readiness for doctoral work. After about 30 hours of work in residence beyond the M.A. degree the student will be admitted to a comprehensive preliminary examination in which he must demonstrate a reading knowledge of two foreign languages, competence in research design and applied statistics, and a knowledge of such core areas of psychology as may be required of all students.

Upon passing the qualifying examination, the student will be formally promoted to candidacy for the doctorate. He will then be assigned a doctoral committee which will direct his further course work and his dissertation research, and will approve his internship setting.

After completion of a satisfactory dissertation and all other requirements, the candidate will take a final examination, written, or oral, over his major and minor specialties and the dissertation.

PSYCHOLOGY

202. **JOB ANALYSIS.** I or II. 3 hr. PR: Psych. 203 or consent. Instruction and supervised practice in the preparation of job analyses and in the use of occupational descriptions. Especially designed for students in psychology, guidance, engineering, management, and rehabilitation counseling.
203. **PERSONNEL PSYCHOLOGY.** I or II. 3 hr. PR: Psych. 1 and a course in statistics. Application of psychological principles and techniques to the problems of measurement and prediction of proficiency in industry and society. Topics include proficiency measurement, personnel selection by tests and interviews, conditions of work and productivity, engineering psychology, work methods, and safety.
211. **STATISTICAL METHODS IN PSYCHOLOGY.** I or II. 3 hr. PR: Psych. 111 or equiv. Sampling theory, probability, further parametric and nonparametric statistics.
212. **HISTORY OF PSYCHOLOGY.** I or II. 3 hr. PR: Psych. 1. Traces the development of the science and concepts of psychology from their origin in philosophy, physiology, and medicine up to the modern era.
213. **DIRECTED STUDIES.** I, II. 1-3 hr. per sem.
215. **ANALYSIS OF VARIANCE.** I or II. 3 hr. PR: Psych. 211 or consent. A discussion of tests of homogeneity of variance, parametric and non-parametric analysis of variance, and analysis of covariance. Implications of these techniques for experimental design will be considered.
217. **MULTIVARIATE ANALYSIS.** I or II. 3 hr. PR: Psych. 211 or consent. Correlational methods in psychology with application to typical research problems. Includes simple matrix algebra, multiple correlation, discriminant analysis, and an introduction to factor analysis.
221. **SENSORY PROCESSES.** I or II. 3 hr. PR: Psych. 121 and 122. Psychophysics of vision and audition are analyzed and related to current theories. Methods of research in sensory processes are reviewed.
223. **PERCEPTUAL AND COGNITIVE PROCESSES.** I or II. 3 hr. PR: Psych. 121 and 122, or equiv. Consideration of classical and contemporary research and theory on perception and cognitive processes, including concepts formation and thinking.

224. MOTIVATION. I or II. 3 hr. PR: Psych. 121, 122, or equiv. Survey of experimental data and theory in the area of motivation especially as it relates to learning.

227. CONDITIONING AND LEARNING. I or II. 3 hr. PR: Psych. 121 and 122. Outline of current research in operant and classical conditioning. Controversial issues in learning are reviewed in light of recent research and theory.

231. PHYSIOLOGICAL PSYCHOLOGY. I or II. 3 hr. PR: Psych. 121, 122, and Zool. 271 or equiv. The organic basis for psychological activities such as perception, emotion, motivation, and learning.

232. COMPARATIVE PSYCHOLOGY. I or II. 3 hr. PR: Psych. 121 and 122. Comparison of the structure of representative animals of the various phyla in relation to differences in behavior.

243. CHILD BEHAVIOR. I or II. 3 hr. PR: Psych. 1. Growth trends in behavior through adolescence, including development in the physical, intellectual, emotional, social, and personality areas.

247. ADOLESCENCE AND EARLY ADULTHOOD. I or II. 3 hr. PR: Psych. 243, 263, 281, or equiv., and consent. Psychosexual, psychosocial, and other focal problems of development will be stressed. The role of high school and higher education in growth and development will be examined.

251. ADVANCED SOCIAL PSYCHOLOGY. I or II. 3 hr PR: Psych. 151 or consent. Consideration of contemporary theory and practice in social psychology. A research project is generally assigned.

252. GROUP DYNAMICS. (Same as Sociol. 270). I or II. 3 hr. PR: Psych. 1, Soc. 1, or permission. An interdepartmental course, combining psychological and sociological approaches, in which the dynamics of groups in operation are considered. The following topics are treated: leadership, informal communication and group processes, the relations of group aims to group organization, and the effect of the group on personality.

253. ATTITUDES AND PROPAGANDA. I or II. 3 hr. PR: Psych. 1 or consent. Includes: the nature of attitudes and opinions, attitude measurement, opinion changing, propaganda use and analysis, the social psychology of mass media, democratic values and public opinion. Designed to meet the needs of students from a variety of fields as well as psychology—especially sociology, political science, and journalism.

261. INDIVIDUAL DIFFERENCES. I or II. 3 hr. PR: One course in psychology. Nature and extent of differences among individuals in such traits as intelligence, achievement, personality, and interests as affected by hereditary and environmental differences and by such variables as schooling, socioeconomic status, sex, age, and race. Primarily for students of psychology and education.

262. GROUP PSYCHOMETRIC TESTING. I or II. 3 hr. PR: Psych. 1, 111, or equiv. Theory underlying the construction and use of psychometric measurement techniques for evaluating aptitude, interest, personality, and attitudes.

263. INTRODUCTION TO PERSONALITY. I or II. 3 hr. PR: Psych. 1. The development and significance of the personality concept in psychology including a survey of the major theories such as Freudian, interpersonal, trait, and learning.

264. PSYCHOLOGY OF ADJUSTMENT. I or II. 3 hr. PR: Psych. 1 or consent. Dynamic principles of human personality adjustment.

271. INTRODUCTION TO CLINICAL PSYCHOLOGY. I or II. 3 hr. PR: Psych. 263, 281 or consent. Review of concepts, techniques, and professional roles in clinical psychology. Foundation for advanced courses in clinical methods and skills. Of interest to advanced undergraduates and graduates in education, guidance, personnel, pre-medicine, and social work as well as professionally-oriented students in psychology.

281. ABNORMAL PSYCHOLOGY. I or II. 3 hr. PR: Psych. 1 Survey of the major behavioral disorders: neurosis, psychosis, and character disorder. Emphasis is

placed on the developmental dynamics leading to these disorders, and the psychological treatments of them.

282. **EXCEPTIONAL CHILDREN. I or II. 3 hr. PR:** Child or educational psychology. Study of children who present psychological problems because of: (1) exceptional mental retardation or advancement; (2) organic disabilities having behavior consequences, such as cerebral palsy or deafness; (3) disorders of conduct associated with atypical personality functioning. Of special interest to those who regularly deal with children such as teachers, nurses, etc.

304. **LEADERSHIP AND HUMAN RELATIONS IN WORKING GROUPS. I or II. 1-3 hr. PR:** Consent. Individual work related to either research or practice in the field of human relations training programs.

307. **PRACTICUM IN INDUSTRIAL INTERVIEWING. I or II. 3 hr. PR:** Psych. 203 or consent. An intensive review of principles of selection and validation as they relate to the interview. Practice interviews applying non-directive techniques in employment and other types of interviews with critiques by instructor.

309. **SEMINAR: INDUSTRIAL. I or II. 2 hr. per sem. PR:** Consent. Current research and problems in industrial psychology.

318. **FACTOR ANALYSIS. I or II. 3 hr. PR:** Psych. 217 or consent. Alternate methods for factor extraction, communalities, rotation in orthogonal and oblique space, and the estimation of factor scores.

319. **SEMINAR: METHODOLOGY. I or II. 2 hr. per sem. PR:** Consent. Current problems in statistics and research methods.

323. **HUMAN LEARNING. I or II. 3 hr. PR:** Psych. 121, 122 or equiv. Historical and contemporary review of research and theory in verbal learning, transfer, mediation, retention and memory processes, including motor skill learning, verbal conditioning.

325. **THEORY CONSTRUCTION. I or II. 3 hr. PR:** Psych. 121 and 122. Consideration of the methods of theory construction and the role of theory in selected areas of psychology.

328. **SEMINAR: LEARNING. I or II. 2 hr. per sem. PR:** Consent. Current research and problems in the psychology of learning.

337. **SEMINAR: PHYSIOLOGICAL. I or II. 2 hr. per sem. PR:** Consent. Current research and problems in physiological psychology.

342. **INFANCY AND CHILDHOOD. I or II. 3 hr. PR:** Psych. 243, or equiv. A theoretical study of psychological growth. Comparative and crosscultural research is emphasized.

334. **MATURITY AND OLD AGE. I or II. 3 hr. PR:** Psych. 243, 263, 281 or equiv. and consent. Cognitive and personality changes in middle and old age. Psychological reactions to physiological decrement and dissolution of family units. Emphasis on research and theory explaining aging phenomena.

349. **SEMINAR: DEVELOPMENT. I or II. 2 hr. per sem. PR:** Consent. Current research and problems in developmental psychology.

359. **SEMINAR: SOCIAL. I or II. 2 hr. per sem. PR:** Consent. Current research and problems in social psychology.

363. **PERSONALITY THEORY AND RESEARCH. I or II. 3 hr. PR:** Psych. 263, 211 or equiv. Intensive analysis of current research and theory in the personality area.

369. **SEMINAR: PERSONALITY AND ABILITIES. I or II. 2 hr. PR:** Consent. Consideration of a current problem in the personality and trait measurement areas.

371. **INDIVIDUAL INTELLIGENCE TESTING. I or II. 3 hr. PR:** Psych. 243 and 262, or consent. Theory and practice in Binet, Wechsler, and other individual tests of cognitive functioning.

372. INTELLIGENCE TESTING PRACTICUM. I or II. 1-3 hr. PR: Psych. 371 and consent. Supervised experience in making intellectual evaluations in psychiatric, educational, and institutional settings. The student is also taught to use a number of ancillary assessment devices in evaluating exceptional children.

373. PERSONALITY ASSESSMENT TECHNIQUES. I or II. 3 hr. PR: Psych. 281, 263, or 363, 371 and consent. Administration, scoring and interpretation of personality assessment techniques, including the Rorschach, Thematic Apperception Test, MMPI, and other objective and projective methods.

374. ADVANCED PERSONALITY ASSESSMENT. I or II. 3 hr. PR: Psych. 373 and consent. Supervised practice in the diagnostic application of personality assessment techniques. Includes clerkship in university counseling center and/or other mental health facilities.

375. COUNSELING AND PSYCHOTHERAPY. I or II. 3 hr. PR: Psych. 263, 281 or equiv. Individual and group psychotherapy.

376. PRACTICUM IN COUNSELING AND PSYCHOTHERAPY. I or II. 1-3 hr. PR: Psych. 316 or equiv. Supervised experience in psychotherapeutic techniques used by the psychologist in a clinic setting.

377. CLINICAL PSYCHOLOGY PRACTICUM. I or II. 1-6 hr. per sem. PR: Psych. 372 and consent. Supervised practice of psychological techniques in clinics or institutional settings. Includes experience in psychological testing, interviewing, report writing, case presentation, interpretation of tests and counseling with parents. Primarily for students in the master's program with clinical emphasis.

378. ADVANCED CLINICAL PRACTICUM. I or II. 1-6 hr. per sem. PR: Psych. 374, 375, or consent. Supervised practice of psychological techniques in clinics or institutional settings. Psychological evaluation, counseling and psychotherapy, clinical consultation. Emphasis is placed on experiences in multi-disciplinary counseling and mental health settings. Primarily for advanced doctoral students in clinical psychology.

379. SEMINAR: CLINICAL. I or II. 2 hr. per sem. PR: Consent. Current research and problems in clinical psychology.

381. BEHAVIOR PATHOLOGY. I or II. 3 hr. PR: Psych. 263, 281 or consent. Advanced study of etiology and dynamics of severe behavior pathology.

389. SEMINAR: ABNORMAL. I or II. 2 hr. per sem. PR: Consent. Current research and problems in abnormal psychology.

390. TEACHING PRACTICUM. I or II. 1-3 hr. PR: Consent. Supervised practice in college teaching of psychology.

391. DIRECTED STUDY. I or II. 1-3 hr. per sem. PR: Consent. Directed reading and research in special areas.

392. MASTER'S THESIS. I, II. 1-6 hr.

397. DISSERTATION RESEARCH. I, II. 1-15 hr.

399. SEMINAR: PROFESSIONAL PROBLEMS. I or II. 2 hr. per sem. PR: Consent. Current problems involved in the practice of psychology.

RELIGIOUS STUDIES

210, 211. PROBLEMS IN CONTEMPORARY CHRISTIAN THINKING. I, II. 3 hr. ea. sem. Issues to be treated include the following: the function of reason in the Christian faith, the Christian understanding of history, the ecumenical and other recent movements within the Church, recent transformations of ethical and social thinking, and new interpretations of traditional Christian doctrines. It is highly recommended, but not required, that Religion 100, 101, 102, or 103 be taken as a background for this course. Each semester may be taken independently.

212. **JUDAEO-CHRISTIAN TEACHINGS ABOUT THE PROBLEMS OF MAN.** I. 3 hr. PR: Either a 100 Religious Studies course or consent. (Offered for first time in Fall, 1967). A presentation of the dialog between the existential problems of man, e.g., anxiety, loneliness, meaninglessness, guilt, death, lust, wrath, and others, and the response of the Judaean-Christian faith. The course embraces an introduction to existential theology.

222. **HISTORY OF AMERICAN RELIGION.** I. 3 hr. PR: A Religious Studies course of the origins, growth, and significance of the major religious ideas and movements, Protestant, Catholic, and Jewish, and including the sects and cults which have been particularly influential in shaping the religious life of the American people.

223. **ROMAN CATHOLIC THOUGHT: FROM THE COUNCIL OF TRENT TO VATICAN COUNCIL II.** II. 3 hr. PR: A 100 Religious Studies course or consent. Roman Catholic thinkers and movements in doctrinal, biblical, historical, and social thought; the reform and renewal movement of Vatican Council II; the role of Roman Catholicism in contemporary society.

230. **WORLD RELIGIONS: RELIGIONS OF INDIA.** I. 3 hr. Hinduism, early Buddhism, Jainism, Sikhism, historical and theological foundations; developments of thought; contemporary expressions and encounter with the modern world.

231. **WORLD RELIGIONS: RELIGIONS OF CHINA AND JAPAN.** II. 3 hr. Buddhism, Confucianism, Taoism, Shinto: historical and theological foundations; developments of thought; contemporary expressions and encounters with the modern world.

240, 241. **THEOLOGY OF CULTURE.** I, II. 3 hr. PR: A 100 Religious Studies course or consent. An interdisciplinary course involving members of various parts of the faculty of the University in dialog with a professor of religious studies. An encounter between theology and the various secular fields of study. Each semester may be taken independently.

SOCIOLOGY

Candidates for the Master's Degree in Sociology must have an adequate undergraduate preparation in sociology or make up the deficit by taking courses which will not be credited toward the graduate degree. This latter may mean an additional semester or summer term of study. If not taken for undergraduate credit, Sociology 202 and 246 (or equivalents), and a course in statistics will as a rule be included in the master's program. A thesis is required of all candidates for the master's degree. Except where the student has a strong preparation in sociology, the thesis requirement is in addition to 30 hours of course work. The candidate must pass a final examination, which may be oral, written, or both, at the discretion of the Department. A part of this examination will test the candidate's general comprehension of the field of Sociology.

Recommended graduate minors are Economics, History, Political Science, Psychology, or Social Work.

Sociology 1 or equivalent, or Social Science 1, 2 is prerequisite for all courses in the 200 series.

SOCIOLOGY

202. **INTRODUCTON TO SOCIAL RESEARCH.** I 3 hr. Trends in social research; examination and methods and techniques.

205. **URBAN SOCIOLOGY.** II. 3 hr. Sociological analysis of institutional structure, social values, and individual goals in urban-industrial society; bureaucratization, collectivization, and mass culture; emphasis on political, economic, religious, and family institutions.

206. **SOCIOLOGY OF RURAL LIFE.** II. 3 hr. Social aspects of rural living. Characteristics of rural population, social structure, and institutional arrangements: family, community, education, religion, recreation, health, welfare, and local government.

208. **THE COMMUNITY.** II. 3 hr. An analytical course intended chiefly to provide background data for students interested in programs of community action. Topics to be included are: the basic characteristics of communities; community institutions and resources; social cleavage within the community; and community survey and community planning.

210. **THE FAMILY.** I, II. 3 hr. Sociological analysis of the contemporary family and its problems.

211. **SOCIOLOGY OF CHILDHOOD.** II. 3 hr. Adjustment of child to American culture.

216. **SOCIOLOGY OF EDUCATION.** I, II. 3 hr. An examination of education as a social institution; cultural and class influences on education; social roles and career patterns in the school system; the school and problems of the community.

220. **SOCIAL CHANGE.** I. 3 hr. Sociological analysis of the major changes now going on in our society, of the forces underlying them, and of the tensions to which they give rise. Alternative future directions; rational manipulation and planning for social change.

224. **SOCIAL STRATIFICATION.** I. 3 hr. Description and analysis of various types of stratification systems, such as class and caste; social mobility, and status-striving. The course emphasizes the place of status, prestige, and power in the structure of American society.

229. **POPULATION AND MIGRATIONS.** I. 3 hr. Population theories; growth, composition, and distribution of American population; immigration and culture pluralism; internal migrations and their consequences.

231. **RACE RELATIONS.** I. 3 hr. Race relations in the U.S. with emphasis on the American Negro.

233. **CRIMINOLOGY.** II. 3 hr. Explanation of crime; critical study of criminal justice, penal methods, and reform movements.

234. **JUVENILE DELINQUENCY.** I. 3 hr. A scientific study of the nature, extent, and causes of delinquency in the United States. Methods of treatment, correction, and prevention, with emphasis on the work of the juvenile courts.

235. **COLLECTIVE BEHAVIOR.** II. 3 hr. Analysis of new group formation and behavior following social dislocation, social unrest, crowd behavior, and other forms of social contagion; the public and public opinion; social movements.

244. **CULTURE AND PERSONALITY.** I. 3 hr. Significant interrelations between the individual and his culture.

246. **TYPES OF SOCIOLOGICAL THEORY.** II. 3 hr. Examination of leading schools of sociological thought in our day.

250. **HUMAN RELATIONS IN INDUSTRY.** II. 3 hr. The sociology of industrial relations. The factory of business firm as a social system. Formal and informal relations within the plant.

260. **COMPLEX ORGANIZATIONS.** I. 3 hr. A sociological analysis of large-scale organizations, emphasizing their structure and functions. The course will examine the place in contemporary society of such organizations as the military, prisons, and hospitals.

265. **THE SOCIOLOGY OF LATIN AMERICA.** II. 3 hr. A systematic sociological consideration of the problems of the "underdeveloped" countries with special emphasis on Latin America: its culture, social structure, and national character. The main emphasis will be on social change.

270. **GROUP DYNAMICS.** (Same as Psych. 270.) I. 3 hr. An interdepartmental course, combining psychological and sociological approaches, in which the dynamics of groups in operation are considered.

275. **CULTURAL DYNAMICS.** I. 3 hr. The nature of culture and culture change. Historical trends in the study of cultural dynamics: focal interests, doctrines, and methods of study.

281. AFRICAN SOCIETY AND CULTURE. II. 3 hr. Analysis of contemporary societies and cultures south of the Sahara, with some emphasis on current changes.
282. LATIN-AMERICAN SOCIETY AND CULTURE. II. 3 hr. A survey of the post-conquest societies and cultures, with emphasis on present-day types of sociocultural arrangements.
285. INTRODUCTION TO ARCHAEOLOGY. I. 3 hr. Survey of archaeology: its methods and significance for the understanding of prehistoric cultures.
286. ARCHAEOLOGY OF APPALACHIA. II. 3 hr. Intensive study of the content distribution, sequence, and significance of early Appalachian Indian cultures.

Prerequisite for all courses in the "300" series: Consent of department chairman.

371, 372. THESIS. I, II. 1-6 hr.

391. GENERAL SEMINAR. I, II. 3 hr.

392. GENERAL SEMINAR. I, II. 3 hr.

393. SEMINAR IN SOCIOLOGICAL RESEARCH. I, II. 3 hr.

394. SEMINAR IN SOCIOLOGICAL RESEARCH. I, II. 3 hr.

395. SEMINAR IN SOCIOLOGICAL THEORY. I, II. 3 hr.

396. SEMINAR IN SOCIOLOGICAL THEORY. I, II. 3 hr.

SPEECH

THE DEGREE OF MASTER OF ARTS

The Department of Speech offers work leading to the Master of Arts degree in General Speech, Rhetoric and Public Address, and Radio, Television, and Motion Pictures. Persons who possess a Bachelor's degree from an accredited college or university may be admitted to the program. Although normally the entering graduate student has an undergraduate major in speech, qualified students from related areas are admitted with the understanding that any deficiencies in undergraduate preparation in speech must be made up without credit toward the Master of Arts degree, or added to the credit requirements of the degree.

In addition to the general requirements of the Graduate School, the graduate student in speech must meet the following departmental requirements:

I. Successful completion of the minimum number of required graduate hours as set forth in Program A or Program B below.

II. Completion of Speech 301 and at least one Seminar in speech.

III. Successful passage of three 3-hour written comprehensive examination in the areas of study pursued at the graduate level.

A. A "B" average is pre-requisite to the writing of such examinations.

B. No student shall be considered a candidate for the Master's degree in speech, nor permitted to take the final oral examination, until he has passed his comprehensive examinations.

PROGRAM A — THE THESIS PROGRAM

1. Successful completion of at least thirty hours of graduate credit, twenty-one of which must be in the curriculum of the Department of Speech.
 - a. A maximum of six hours of research and/or thesis may be included in the twenty-one hours.
 - b. Problem topics in Speech 375 (Independent Study), and Speech 397 (Research), may not be expanded into a thesis.
2. Pursuit of courses in cognate fields upon the advice and approval of the Departmental Graduate Committee.
3. A thesis demonstrating original research and scholarly reporting.
4. Passage of an oral examination on the thesis.

PROGRAM B — THE NON-THESIS PROGRAM

1. Successful completion of a minimum of thirty-six semester hours of graduate credit, twenty-four of which must be in the curriculum of the Department of Speech.
2. Pursuit of courses in cognate fields, upon the advice and approval of the Departmental Graduate Committee.
3. Passage of an oral examination relating to speech theory, principles, methodology, and philosophy to ascertain the candidate's general knowledge in the field of speech, may be required.

PUBLIC SPEAKING

220. SPEECH COMPOSITION. II. 3 hr. PR: Speech 11 and consent. An upper-division course which stresses the theories of organization, support, and style. Study of model speeches and the writing of speeches; application to delivery.
221. PERSUASION. I. 3 hr. PR: Speech 11 and consent. Study and practice in identification of factors motivating human behavior and belief, how to secure and hold attention, the uses of suggestion, the dramatization of ideas. Application to advertising and writing as well as speaking.
222. FORMS OF PUBLIC ADDRESS. II. 3 hr. PR: Consent. Composition and delivery of the oration, political speech, the speech of introduction, dedicatory address, and eulogistic speech.
223. ADVANCED GROUP DISCUSSION. II. 3 hr. PR: Consent. Application of the principles and practices of group discussion to classroom teaching, the conference tables, committee work, policy-determining groups, and the public forum.
225. INTERSCHOLASTIC FORENSICS. S. 3 hr. PR: Consent. Interscholastic public speaking activities, with emphasis upon types commonly termed original speech, such as debate, oratory, and extemporaneous speaking. Opportunity for performance in each type will be provided.
330. HISTORY OF RHETORIC. I. 3 hr. PR: Consent. Critical study of rhetoric from classical times to the present. Special attention given to Aristotle, Cicero, and Quintilian.
335. HISTORY OF AMERICAN PUBLIC ADDRESS. II. 3 hr. PR: Consent. Critical study of leading American speakers, their biographies, outstanding speeches, and issues with which they dealt.
339. SEMINAR: PROBLEMS IN SPEECH. I, II. 3 hr. PR: Consent. Current research and problems in General Speech and Rhetoric and Public Address.

RADIO, TELEVISION, MOTION PICTURES

280. RADIO AND TELEVISION DRAMATIC WRITING. II. 3 hr. PR: Speech 80 and Speech 184 or consent. Theory and practice of the basic principles of broadcast dramatic script writing. Documentaries, poetry programs, serial dramas, and children's shows for commercial and educational purposes. Scripts are written to be aimed at definite markets.
282. RADIO WORKSHOP. I. 3 hr. PR: Speech 181 or Speech 182, or consent. Discussion of techniques of radio production. Laboratory experience in the production of University radio programs. Adapted to students interested in commercial and educational broadcasting.
283. TELEVISION WORKSHOP. I. 3 hr. PR: Speech 185 or consent. Discussion of techniques of television production. Laboratory experience in the production of University television programs. Adapted to students interested in commercial and educational broadcasting.
284. RADIO AND TELEVISION PROGRAM PLANNING. II. 3 hr. PR: Speech 80 and consent. Analysis of the purpose and basic idea of a program in relation to audience composition. Requirements of effective structure. Practice in laying out program formats for all types of radio and television programming.

388. **FILM DIRECTING AND CINEMATOGRAPHY.** I or II. 3 hr. PR: Speech 289. Laboratory fee. An advanced study of motion picture production from the directional and cinematographic standpoint. Students will be expected to complete the full production of a motion picture as their term project.

389. **SEMINAR: PROBLEMS IN RADIO TELEVISION AND MOTION PICTURES.** I or II. 3 hr. PR: Consent. Discussion and research into various issues and problems in the broadcast media.

RELATED COURSES

270. **PSYCHOLOGY OF SPEECH.** II. 3 hr. PR: Consent. Modern psychological principles of speech learning and usage. Influences of emotion, conditioning, and habit on listening, thinking, language, learning, judgments, imagery, and personality as factors in oral communication.

275. **SPEECH PROBLEMS OF CHILDREN.** S. 3 hr. PR: Consent. Normal maturational development of listening and speaking skills, their relationships to language acquisition, and their influences upon achievement in reading and writing. Primarily for elementary school teachers and principals, language arts supervisors, speech therapists, and students in guidance and counseling.

301. **RESEARCH PROBLEMS AND METHODS.** I. 3 hr. PR: Graduate standing. Required of all candidates for Master's Degree in Speech.

375. **INDEPENDENT STUDY.** I, II. 1-3 hr. PR: Speech 301, a speech seminar, and consent of chairman of department. Open to graduate students in speech who are pursuing independent problems in that field.

397. **RESEARCH.** I, II. 1-3 hr. PR: Speech 301, a speech seminar, and consent of chairman of department. For graduate students in speech.

399. **THESIS.** I, II. 2-4 hr.

COMMERCE

The College of Commerce offers graduate programs in business administration and economics. The program in business lead to the degrees of Master of Business Administration (M.B.A.) and Master of Science (M.S.). These programs are supervised by the Graduate Faculty in Business Administration and students in them are administered by the Director of Graduate Programs in Business.

Graduate programs in economics lead to the degrees of Master of Arts (M.A.) and Doctor of Philosophy (Ph.D.). These programs are supervised by the Graduate Faculty in Economics and students in them are administered by the Director of Graduate Programs in Economics.

All graduate programs in the College of Commerce require that the student maintain a grade-point average of at least 3.0 (B) on all work taken as a graduate student at the University, including prescribed work taken to remove undergraduate deficiencies. A student whose cumulative grade-point average falls below 2.5 will be placed on probation. If his average is not brought up to 2.5 by the end of the following semester, he will be suspended. A grade below "C" in any course taken while enrolled as a graduate student will result in suspension from the graduate programs of the College of Commerce.

All work for a graduate degree must be completed within a period of seven years. An extension of this period must be approved in writing by the appropriate graduate faculty and the dean of the Graduate School.

GRADUATE PROGRAMS IN BUSINESS ADMINISTRATION

To be considered for admission to the program an applicant must have a baccalaureate degree from an accredited college or university, with an undergraduate average of at least 2.5 (of a possible 4.0) or a baccalaureate degree and an acceptable score on the Admission Test for Graduate Study in Business. To assure that all students in the program have the same foundation in business, the applicant must have completed the following courses:

- Principles of Accounting (2 semesters)
- Principles of Economics (2 semesters)
- Principles of Marketing
- Principles of Management (or Industrial Management)
- Business Finance
- Principles of Statistics

A student without the necessary prerequisite courses may be admitted on probation subject to removal of any deficiencies at the beginning of the program. All applicants for graduate work at West Virginia University must submit scores in the general aptitude test of the Graduate Record Examination. Students may be admitted provisionally without the GRE examination, but must take it on the first date it is offered after admission. After December 31, 1967, applicants will also be required to take the Admission Test for Graduate Study in Business before being considered for admission.

MASTER OF BUSINESS ADMINISTRATION (M.B.A.)

The candidate's program of courses will be planned with the assistance of a faculty adviser and must have his approval. The M.B.A. degree requires a total of 36 hours of graduate credit, including the following courses:

First Semester

Accounting	301—Managerial Control, 3 hr.
Economics	301—Managerial Economics, 3 hr.
Economics	302—Research and Reports, 1 hr.
Management	301—Administrative Practices, 3 hr.
Management	302—Quantitative Business Analysis, 3 hr.

Second Semester

Economics	302—Research and Reports, 2 hr.
Finance	313—Financial Administration, 3 hr.
Management	313—Production Administration, 3 hr.
Marketing	313—Marketing Administration, 3 hr.

Summer Session

Management	323—Administrative Policy, 3 hr.
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The candidate will also complete 9 semester hours of elective courses selected with the approval of his adviser. Of these electives, at least 3 hours must be in a graduate course of the College of Commerce at the 300 level, preferably in a graduate seminar in business. No thesis is required, but writing is emphasized in all courses. The candidate must pass a comprehensive examination covering the material in the required courses. This examination is normally taken during the semester in which the required courses will be completed and may be repeated only once.

MASTER OF SCIENCE (M.S.)

A program of courses will be planned by the candidate with his faculty adviser and is subject to the approval of his adviser. The M.S. degree requires 30 semester hours of graduate credit, including an acceptable thesis. No more than 6 hours may be taken outside the College of Commerce. The candidate must complete at least 21 hours of 300-level courses, and should include the following courses in his program if he has not already completed them:

Economics	211—Micro Economic Analysis <i>or</i> Economics 301—Managerial Economics, 3 hr.
Economics	220—Introduction to Quantitative Analysis, 3 hr.
Economics	302—Research and Reports, 1 hr.
Management	225—Business Policy <i>or</i> Management 323—Administrative Policy, 3 hr.

A graduate seminar in business administration, 3 hr.

GRADUATE PROGRAM IN ECONOMICS

All applicants must take both the general aptitude test and the economics advanced test of the Graduate Record Examination. Prior to admission to the program, students are required to have completed at least 18 semester hours of course work in economics. Six of these hours may be in principles of economics, at least 3 hours must be in statistics, and not more than 3 hours may be from the functional fields of accounting, finance, marketing, management, etc. A minimum grade of "C" is required in each of the courses taken to meet the 18 hour economics requirement. Applicants must have a 2.5 grade-point average for the last 60 hours of undergraduate work.

Students who do not meet these entrance requirements may be admitted on probation subject to the correction of the deficiencies at the beginning of the program. Deficiencies in undergraduate preparation must be removed without graduate credit.

Graduate students in economics must earn a grade-point average of 3.0 (B) in all graduate courses. No credit will be accepted toward the Ph.D. degree (as distinguished from the Masters degree) for graduate courses in economics in which grades lower than "B" are reported.

MASTER OF ARTS (M.A.)

The candidate's program of courses will be planned with the assistance of the faculty adviser and must have his approval. The M.A. degree requires a total of 30 semester hours of graduate credit, including 18 hours in the graduate core curriculum in economics and an acceptable thesis (6 hours). The students must make a passing grade on a qualifying examination in statistics, or alternately, a minimum grade of "B" in Advanced Statistics (Economics 226 or an equivalent course).

The following courses constitute the graduate core curriculum in economics:

Economics

- 310—Advanced Micro Theory I, 3 hr.
- 311—Advanced Micro Theory II, 3 hr.
- 312—Advanced Macro Theory I, 3 hr.
- 313—Advanced Macro Theory II, 3 hr.
- 316—History of Economic Doctrines and Analysis, 3 hr.
- 320—Quantitative Analysis, 3 hr.

DOCTOR OF PHILOSOPHY (Ph.D.)

At least three years of full-time graduate work beyond the baccalaureate degree are usually required to qualify for the doctorate. Two of the three years of residence must be at West Virginia University, including at least two consecutive semesters in actual residence as a full-time graduate student.

The Ph.D. degree is not awarded for the mere accumulation of course credits nor for the completion of the specified residence requirements. A minimum, however, of 36 hours of graduate work in economics at the 300-level is required for all candidates for the Ph.D. degree in economics. These must include 18 hours in the graduate core curriculum in economics which includes:

Economics

- 310—Advanced Micro Theory I, 3 hr.
- 311—Advanced Micro Theory II, 3 hr.
- 312—Advanced Macro Theory I, 3 hr.
- 313—Advanced Macro Theory II, 3 hr.
- 316—History of Economic Doctrines and Analysis, 3 hr.
- 320—Quantitative Analysis, 3 hr.

Three additional hours must consist of a seminar in the candidate's field of concentration. The remaining 15 hours will be selected by the student with approval of his adviser.

For admission to candidacy for the Ph.D. Degree the student must:

1. Demonstrate in an examination a knowledge of two of the following languages: French, German, and Russian.
2. Demonstrate proficiency in statistical technique by successful completion of a qualifying examination or, alternatively, by achieving a minimum grade of "B" in Advanced Statistics (Economics 226 or an equivalent course).
3. Successfully complete preliminary examinations in four fields which include economic theory (Micro Theory, Macro Theory, and History of Economic Doctrines), two other fields of concentration in economics and one other field in economics or in an outside area. The selection of an outside field must be done with the advice and consent of the student's graduate committee.

When an applicant has successfully passed his qualifying examinations, he will be formally promoted to candidacy for the doctoral degree. Admission to candidacy must precede the final examination for the doctoral degree by at least one academic year.

The candidate must submit a thesis pursued under the direction of the Graduate Faculty in Economics on some problem in the area of the candidate's major interest. The thesis must present the results of the candidate's individual investigation and must embody a definite contribution to knowledge. It must be approved by a committee of the Graduate Faculty in Economics. An oral examination on the thesis is required.

After approval of the candidate's thesis and satisfactory completion of other graduate requirements, he shall have a final examination by his advisory committee. See the General Regulations for Graduate Degrees on page 33 for further information on the dissertation, residence requirements, final examination, request for degree, and attendance at commencement.

ACCOUNTING

- 211. ACCOUNTING SYSTEMS. I. 3 hr. PR: Accounting 112. The adaption of accounting procedures to the demands of the firm, with emphasis on theoretical factors important to efficiency and internal control; system surveys and reports, the design of forms, office machine applications.

213. INCOME TAX ACCOUNTING. I. 3 hr. PR: Accounting 112 or consent. Tax theory and practice as developed from the regulations of the Internal Revenue Service; problems in preparation of tax returns for individuals, partnerships, and corporations.

214. INCOME TAX ACCOUNTING. II. 3 hr. PR: Accounting 213. A continuation of Accounting 213.

216. ADVANCED COST ACCOUNTING. II. 3 hr. PR: Accounting 115. Advanced work in the application of cost theory and procedures to cases and problems which emphasize the managerial use of cost information.

217. AUDITING THEORY. I or II. 3 hr. PR: Accounting 112. Auditing fundamentals; objective, standards and procedures; introduction to working-paper techniques; procedure statements of the American Institute of C.P.A.'s.

218. AUDITING PRACTICE. I or II. 3 hr. PR: Accounting 217. Application of auditing theory and procedures, with emphasis on decisions which invoke judgment and are important in independent audits; audit working papers and reports; case studies.

224. ADVANCED ACCOUNTING PROBLEMS. I or II. 3 hr. PR: Minimum of 18 hours in accounting with an average grade of "B" or higher. Analysis and solution of representative C.P.A. problems.

230. ADVANCED ACCOUNTING THEORY. I or II. 3 hr. Accounting 112, 115, and consent. Critical analysis of accounting concepts and standards with emphasis on their origin, development, and significance.

301. MANAGERIAL CONTROL. I. 3 hr. PR: Accounting 52 and Econ. 125. The use and significance of the quantitative techniques of accounting, statistics, and budgeting for planning, control, and decision making.

329. SEMINAR IN ACCOUNTING. I or II. 3 hr.

395. THESIS IN ACCOUNTING. I, II. 1-6 hr.

ECONOMICS

SPECIALIZED COURSES

205. CURRENT ECONOMIC PROBLEMS. S. 3 hr. PR: Econ. 51 and 52 or consent. For students in Education only. A course designed to acquaint public school teachers with reliable source material in economics and to instruct them in studying current economic problems.

301. MANAGERIAL ECONOMICS. II. 3 hr. For students in the M.B.A. Program. An analysis of markets and the problems of management in appraising business conditions and in adjusting to changes in product demand, costs, level of output, and profits.

302. RESEARCH AND REPORTS. I, II. 1-3 hr. For students in the M.B.A. Program. A study of sources of business information and research procedures, with application in the preparation of reports.

ECONOMIC THEORY

210. COMPARATIVE ECONOMIC SYSTEMS. I or II. 3 hr. Structure and processes of existing economic systems throughout the world including review of basic principles of free enterprise, socialistic, communistic, and fascistic societies. Comprehensive analysis based on current and recent experiments in these economies.

221. MICRO ECONOMIC ANALYSIS. I. 3 hr. A study of price and output determination and resource allocation in the firm under various competitive conditions.

212. MACRO ECONOMIC ANALYSIS. II 3 hr. An analysis of the forces which determine the level of income, employment, and output. Particular attention is given to consumer behavior, investment determination, and government fiscal policy.

213. **ECONOMIC DEVELOPMENT.** I or II. 3 hr. A comprehensive study of the problems, changes, and principal policy issues faced by non-industrialized countries in the process of economic development.

216. **HISTORY OF ECONOMIC THOUGHT.** II. 3 hr. Economic ideas in perspective of historic development.

310. **ADVANCED MICRO THEORY I.** I. 3 hr. Theory of production and allocation, utility theory, theory of the firm, pricing in perfect and imperfect markets, models of firm's operations.

311. **ADVANCED MICRO THEORY II.** II. 3 hr. PR: Econ. 310 General equilibrium analysis, distribution theory, welfare economics.

312. **ADVANCED MACRO THEORY I.** I. 3 hr. Classical, Keynesian, and Post-Keynesian theories.

313. **ADVANCED MACRO THEORY II.** II. 3 hr. PR: Econ. 312. Models of economic growth and fluctuations.

316. **HISTORY OF ECONOMIC DOCTRINES AND ANALYSIS.** I. 3 hr. Study of the writings of the major figures in the development of economic doctrines and analysis.

319. **SEMINAR IN ECONOMICS.** II. 3 hr.

QUANTITATIVE ECONOMICS

220. **INTRODUCTION TO QUANTITATIVE ANALYSIS.** I 3 hr. PR: Econ. 125. Study of the principal mathematical techniques employed in economic analysis; an introduction to econometrics.

226. **ADVANCED STATISTICS.** II. 3 hr. PR: Econ. 125 or equivalent. An advanced approach to statistical analysis with emphasis on probability, inference, and multi-varied statistical techniques.

320. **QUANTITATIVE ANALYSIS.** II. 3 hr. PR: Econ. 220 or consent. Linear programming, input-output analysis, game theory, decision theory, and dynamic models.

325. **ECONOMETRICS.** I or II. 3 hr. Specification, statistical estimation, and verification of economic models. Problems of applications of econometric analysis.

329. **SEMINAR IN ECONOMIC ANALYSIS.** I or II. 3 hr.

MONETARY ECONOMICS

330. **MONETARY ECONOMICS.** I or II. 3 hr. Sources and determinants of the supply of money; the demand for money for transactions and speculative purposes; general equilibrium theory of money, interest, prices, and output; the role of money in policy.

334. **SEMINAR IN MONETARY ECONOMICS.** I or II. 3 hr.

PUBLIC FINANCE

241. **PUBLIC FINANCE.** I or II. 3 hr. Governmental fiscal organizations and policy; taxes and tax systems with particular emphasis upon the Federal Government and the State of West Virginia.

340. **THEORY OF PUBLIC FINANCE.** I or II. 3 hr. Systematic study of the economic role of government in a mixed economy with regard to resource allocation between the public and private sectors, the influence of government upon income distribution and upon economic stability and growth.

344. **SEMINAR IN PUBLIC FINANCE.** I or II. 3 hr.

PUBLIC REGULATION AND CONTROL

245. **GOVERNMENT AND BUSINESS.** I or II. 3 hr. Government in its role of adviser and umpire; analysis of governmental policies and practices affecting business.

- 246. TRANSPORTATION. I or II. 3 hr. Development of an inland transportation system and relations and policies of transport agencies.
- 345. PUBLIC REGULATION AND CONTROL. I or II. 3 hr. Economic analysis of the public control of enterprises under the jurisdiction of federal and state regulatory authorities.
- 349. SEMINAR IN PUBLIC REGULATION AND CONTROL. I or II. 3 hr.

INTERNATIONAL ECONOMICS

- 250. INTERNATIONAL ECONOMICS. I or II. 3 hr. Development of trade among nations; theories of trade, policies, physical factors, trends, and barriers in international economics.
- 350. ADVANCED INTERNATIONAL ECONOMICS. I or II. 3 hr. Contemporary theories of international economics; analysis of current problems in world trade and finance.
- 354. SEMINAR IN INTERNATIONAL ECONOMICS. I or II. 3 hr.

REGIONAL ECONOMICS

- 255. REGIONAL ECONOMICS. I or II. 3 hr. Analysis of factors that promote or deter the economic growth of a region, with emphasis on such matters as population shifts, economic base studies, industrial location analyses, input-output techniques, regional income estimation, local multiplier and cycle concept, and the role of government in regional growth.
- 355. ADVANCED REGIONAL ECONOMICS. I or II. 3 hr. Regional income and flow of funds estimation, regional cyclical behavior and multiplier analysis, industrial location and analysis, techniques of regional input-output measurement, the impact of local government reorganization on the level of regional public service and economic development.
- 359. SEMINAR IN REGIONAL ECONOMICS. I or II. 3 hr.

LABOR ECONOMICS

- 261. TRADE UNIONISM. I or II. 3 hr. PR: Econ. 160 or consent. Analysis of the structure, government, attitudes, and policies of organized labor; the implications of union policy.
- 262. COLLECTIVE BARGAINING. I or II. 3 hr. PR: Econ. 160 or consent. Theory and practice of collective bargaining; including contract issues, types of relationships, and the role of government policy.
- 263. ECONOMICS OF WAGES. I or II. 3 hr. PR: Econ. 160 or consent. Determination of wage levels and structure; the functioning and organization of labor markets.
- 360. ADVANCED LABOR ECONOMICS. I or II. 3 hr. Economic effects of trade unionism; measurement and impact of unemployment; the functioning of labor markets; the operation of labor unions; selected aspects of collective bargaining; issues in social legislation.
- 364. SEMINAR IN LABOR ECONOMICS. I or II. 3 hr.

OTHER ECONOMICS COURSES

- 390. INDEPENDENT READING IN ECONOMICS. I or II. 3-6 hr. Supervised readings in special areas.
- 395. THESIS IN ECONOMICS. I, II. 1-6 hr.

FINANCE

216. RISK MANAGEMENT. II. 3 hr. PR: Finance 115 or consent. A study of the transferable risks with which the entrepreneur must deal. Emphasis is on the process by which decisions are made for the handling of these risks, including an examination of the contributions and limitations of the insurance system.

313. FINANCIAL ADMINISTRATION. II 3 hr. PR: Finance 111. A study of problems in business finance including those related to the financial structures of corporations and the working-capital and fixed-capital needs of a firm.

329. SEMINAR IN FINANCE. I or II. 3 hr.

395. THESIS IN FINANCE. I, II. 1-6 hr.

MANAGEMENT

213. PROBLEMS IN BUSINESS ADMINISTRATION. I or II. 1-3 hr.

216. PERSONNEL MANAGEMENT. I, II. 3 hr. Principles and practices in the direction, coordination, and remuneration of manpower.

225. BUSINESS POLICY. I, II. 3 hr. PR: Senior standing and consent. Integrated study of policies, organization, facilities, and control techniques of business enterprises.

301. ADMINISTRATIVE PRACTICES. 3 hr. PR: Management 105 or consent. A study of interpersonal relationships through which administration becomes effective. Emphasis is on the human factors, but the influences of economic and technological factors are also considered. Focus is on the importance of harmony between individual needs and organizational goals.

302. QUANTITATIVE BUSINESS ANALYSIS. I. 3 hr. A review of probability and Bayesian Statistics, multiple correlation, linear programming, and planning and control techniques with an introduction to data processing through computer solution to problems in these areas.

313. PRODUCTION ADMINISTRATION. I. 3 hr. PR: Management 111. The review and application of new analytical techniques to complex manufacturing problems.

323. ADMINISTRATIVE POLICY. II. 3 hr. PR: Consent. An integrated study of policies, organization, facilities, and control techniques of business enterprises.

329. SEMINAR IN MANAGEMENT. I or II. 3 hr.

395. THESIS IN MANAGEMENT. I, II. 1-6 hr.

MARKETING

210. INDUSTRIAL PURCHASING. I. 3 hr. PR: Marketing 111. A survey of corporate procurement problems facing modern purchasing executives.

215. MARKETING RESEARCH. II. 3 hr. PR: Marketing 111. The utilization of present-day marketing research techniques in the solution of practical marketing problems, with particular reference to West Virginia.

313. MARKETING ADMINISTRATION. I. 3 hr. PR: Marketing 111. The analysis of problems met by management in distributing goods and services efficiently to consumers.

329. SEMINAR IN MARKETING. I or II. 3 hr.

395. THESIS IN MARKETING. I, II. 1-6 hr.

CREATIVE ARTS CENTER

The Creative Arts Center incorporates within a single administrative unit the Divisions of Music, Art, and Drama. The administrative entity was established in 1964. Construction is now in progress, with completion scheduled in 1968, of a \$7 million Creative Arts Center building which will contain full facilities for the three divisions. This building will contain both the academic needs of the disciplines and also full facilities for the public manifestations of the performing and visual arts, through its theatres and galleries. Each of the divisions offers various graduate degree programs in its appropriate area.

Division of Music

Prospective graduate students in Music are required to have completed the appropriate curriculum of undergraduate study in Music at West Virginia University, or its equivalent at another institution of recognized standing. Acceptance as a candidate for a graduate degree by the Division of Music is based on the outcome of entrance tests in Theory, Music History and auditions on the major instrument and piano. Students will be required to make up any undergraduate deficiencies indicated either from their previous course of study or by the results of these examinations.¹

Applicants for the Ph.D. must submit a score on the Miller Analogies Test. Applicants for the areas of Theory and Composition will be tested more specifically in counterpoint (both 16th and 18th century), form, instrumentation, and orchestration. Applicants seeking acceptance as composition majors must also submit representative compositions for evaluation and approval.

The application for admission and transcript(s) of previous study, as described elsewhere in this bulletin under "Academic Information," must be received by the Director of Admissions *no later than eight weeks prior to the registration date*. Applicants are advised, however, to file their applications well before this deadline. The entrance tests and auditions are administered, on Saturdays, on announced dates six times throughout the school-year and summer. These dates are available upon request. For each semester or the summer session the last date is approximately six weeks prior to registration.²

THE DEGREE OF MASTER OF MUSIC

Candidates must establish an overall grade-point average of 3.0 (B) within a maximum of 36 hours. Applicants will be admitted to candidacy upon the completion of 12 semester hours of graduate study. No student will be admitted to candidacy until he has removed all undergraduate deficiencies and maintained a 3.0 (B) average in all graduate work completed.

Candidates for the Master of Music degree may major in one of five fields: Music Education, Applied Music, Theory, Composition, History of Music.

Graduate students majoring in Music Education will be allowed one of four options, to be determined in consultation with their adviser: (1) Thesis option; (2) Recital option (if the candidate demonstrates at least grade level 8½ ability on his major instrument when entering); (3). Thirty-six hour option; and (4) Certification option (intended for persons possessing a bachelor's degree with a major in music). For the first three options there are the following requirements:

1. Thirty graduate hours for thesis and recital options, thirty-six graduate hours otherwise, with an average of 3.0 (B).
2. Required courses: Music 310, Music 344, Music 346, one course each in the areas of theory and music history, and either Music 340 or Music 342.
3. Achievement of grade level 8 on the major instrument.

¹See Graduate Applied Music Requirements.

²Recent graduates of the Division of Music will be admitted on their past record without these entrance examinations, unless it is deemed necessary by the Dean of the Creative Arts Center.

4. Passing of an oral examination in areas of music education, music history, and music theory.

5. Successful completion of a 4-hour thesis or 2-hour recital for the thesis and recital options respectively.

For the certification option, a special selection of approximately 21 hours is made in cooperation with the Division of Education to satisfy certification requirements. The other hours, to make a total of 36, are electives selected to provide a good background for teaching. Undergraduate courses may be required to make up deficiencies in areas of performance or conducting.

A representative public recital is required of candidates majoring in Applied Music. Composition majors must submit as a thesis a composition in a large form.

All candidates for the Master of Music degree are required to participate at least two clock hours per week for two semesters (or summer terms) in a performing group selected with the approval of the adviser.

A general comprehensive oral examination must be passed by all candidates for the Master of Music degree. Candidates may repeat this examination after a three-month period. The results of the second oral examination will normally be considered final. The examining committee will decide immediately after an unsuccessful second attempt whether a petition for a third attempt will be granted.

The following are the five curricula:

<i>Music Education (with thesis)</i>	<i>Hr.</i>	<i>Applied Music</i>	<i>Hr.</i>
M. 310—Conducting	3	M. 300—Applied Music (major instrument)	8
M. 340—Choral Techniques, or M. 342—Instrumental Techniques ..	2	Two of the following courses:	6
M. 344—Music Education	3	M. 332—Music in the Middle Ages—3	
M. 346—Introduction to Research in Music Education	3	M. 333—Music in the Renaissance—3	
M. 397—Research (thesis)	4	M. 336—Music in the Baroque Period—3	
Music Electives (at least one course each in theory and music history)*	15	M. 337—Music in the Classic and Romantic Periods—3	
		M. 398—Recital	4
	30	Music Electives	12
			30
<i>History of Music</i>	<i>Hr.</i>	<i>Theory</i>	<i>Hr.</i>
(Prerequisite: 12 undergraduate hours in Music History and Literature, such as Music 140, 141, 280, 281, 282, 283, or equivalents.)		M. 330—Introduction to Musical Bibliography	3
M. 330—Introduction to Musical Bibliography	3	One of the following	3
M. 331—Seminar in Musicology ..	3	M. 332—Music in the Middle Ages—3	
M. 332—Music in the Middle Ages ..	3	M. 333—Music in the Renaissance—3	
M. 333—Music in the Renaissance ..	3	M. 336—Music in the Baroque Period—3	
M. 336—Music in the Baroque Period	3	M. 337—Music in the Classic and Romantic Periods—3	
M. 337—Music in the Classic and Romantic Periods	3	M. 349—Psychology of Music	3
M. 367—Analytical Techniques	3	M. 367—Analytical Techniques	3
M. 397—Research (thesis), or M. 396—Two Lecture Recitals	4	M. 370—Orchestration	2
Electives*	5	M. 375—Pedagogy of Theory	3
		M. 381—Nonserial Techniques of 20th Century Composition	2
		M. 382—Serial Techniques	2
		M. 397—Research (thesis)	4
		Electives*	5
			30

*To be eligible for graduation the candidates must demonstrate completion of grade level 8 on their major instrument.

<i>Composition</i>	<i>Hr.</i>
One of the following:	3
M. 332—Music in the Middle Ages—3	
M. 333—Music in the Renaissance—3	
M. 336—Music in the Baroque Period—3	
M. 337—Music in the Classic and Romantic Periods—3	
M. 367—Analytical Techniques	3
M. 360—Composition	6
M. 370—Orchestration	2
M. 375—Pedagogy of Theory	3
M. 381—Nonserial Techniques of 20th Century Composition	2
M. 382—Serial Techniques	2
M. 397—Research (thesis)	4
Electives*	5
	<hr/>
	30

*To be eligible for graduation the candidates must demonstrate completion of grade level 8 on their major instrument.

THE DEGREE OF DOCTOR OF PHILOSOPHY

Admission. Applicants to the program leading to the degree of Doctor of Philosophy must present necessary credentials for evaluation of previous training and experience to the Admissions Committee of the Division of Music. This includes a score on the Miller Analogies Test, a transcript of all grades and must show proof that the applicant has had a minimum of 28 semester-hours in liberal arts studies. Prior to admission to the program the Committee may, at its discretion, require the applicant to take entrance tests in various fields of music, or the I.E.R. Intelligence Scale "C.A.V.D." test (or some similar test of mental ability), or it may require the applicant to present himself for a personal interview, or any of the three. Under normal circumstances the applicant must have attained an average grade of B in courses taken for his Master's degree. However, if sufficient professional experience should warrant, the Committee may waive the requirement of a B average or may grant an applicant conditional admittance subject to the satisfactory completion of certain specified courses or the attainment of a specified grade-point average within a semester's work.

Candidacy. Graduate students meeting the requirements of the Division of Music and the general requirements of the Graduate School will be recommended to the Dean of the Graduate School for admission to candidacy for the degree. These requirements are:

1. Demonstrate the ability to read German and French. (Upon the recommendation of the adviser and with the approval of the Dean of the Graduate School, one other language may be substituted for French or German).
2. Pass written examinations satisfactorily to show:
 - a. Broad knowledge in "Theory" and "Music History and Literature."
 - b. Knowledge in depth in the field of specialization.
3. Pass satisfactorily a comprehensive oral examination covering the entire field of music.
4. Present and have accepted an outline and prospectus of the dissertation.

Graduate students who have met these requirements and who have maintained an average of B in courses completed shall be admitted to candidacy. Should the applicant fail the written examinations he may apply to take them again after a minimum period of three months. Should the applicant fail the comprehensive oral examination he may be examined again after a minimum period of six months. The results of the second oral examination will be considered final. Admission to candidacy must precede the conferring of the degree by at least one year.

Fields of Specialization. Candidates shall select a program within one of the following fields of specialization: (1) Theory; (2) Composition; (3) Music Education; (4) Musicology. In addition, a minor field consisting of a minimum of 12 credit hours in another field of music or a cognate field will be required of all candidates.

and will be chosen with the approval of the doctoral committee. If the candidate's specialization is in Musicology, the minor field will ordinarily be chosen from an appropriate area of Humanities.

Curriculum. The exact amount and nature of course work to be undertaken by a candidate will be determined by the adviser with the approval of the doctoral committee in the light of the candidate's previous preparation and his field of specialization.

Residence. In general, the requirements for the degree of Doctor of Philosophy contemplate at least three years of full-time graduate work. A minimum of 36 weeks is required in residence in full-time graduate study at West Virginia University beyond the master's degree or its equivalent.

Dissertation. The candidate must submit a dissertation pursued at West Virginia University under the direction of a major professor which demonstrates a high order of independent scholarship, originality, competence in research, and an original contribution to the field of specialization. If the candidate's field of specialization is Composition the dissertation will be an original, major (*i.e.*, full-length) composition such as a symphony, concerto, chamber opera, oratorio, symphonic poem, etc.

Final Examination. If the candidate's dissertation is approved and he has fulfilled all other requirements, he will be admitted to the final oral examination before his doctoral committee. At the option of his committee, a written examination may also be required. The final examination(s) shall be concerned with the dissertation, its contribution to knowledge, and the candidate's grasp of his field of specialization and its relation to other fields.

Time Limitation. Requirements for the degree of Doctor of Philosophy must be completed within seven years of admission to candidacy.

THE DEGREE OF DOCTOR OF MUSICAL ARTS IN PERFORMANCE AND LITERATURE

Admission. Applicants to the program leading to the degree of Doctor of Musical Arts must present necessary credentials for evaluation of previous training and experience to the Doctoral Admissions Committee of the Division of Music. This includes copies of programs of recent major recitals, a transcript of all grades, and must show proof that the applicant has had a minimum of 28 semester hours in liberal arts studies. The applicant must also be approved for the program by an Audition Committee, by giving evidence of superior performance, artistic maturity, and extensive repertoire as specified under Graduate Applied Music Requirements. The Audition Committee shall consist of the Director of the Division of Music, the Chairman of the Applied Music Department, and the major professors involved with the degree. To be admitted to the program the applicant must have attained an average grade of B in courses taken for his Master's degree.

Candidacy. Graduate students meeting the requirements of the Division of Music and the general requirements of the Graduate School will be recommended to the Dean of the Graduate School for admission to candidacy for the degree. These requirements are:

1. Demonstrate the ability to read German and French. (Upon the recommendation of the adviser and with the approval of the Dean of the Graduate School, one other language may be substituted for French or German.)
2. Pass written examinations satisfactorily to show:
 - a. Broad knowledge in Theory and Music History and Literature.
 - b. Knowledge in depth in the literature of the field of specialization.
3. Pass satisfactorily a comprehensive oral examination covering the entire field of music.
4. Present a public recital.

Graduate students who have met these requirements and who have maintained an average of B in courses completed shall be admitted to candidacy. Should the applicant fail the written examinations he may apply to take them again after a minimum period of three months. Should the applicant fail the comprehensive oral examination he may be examined again after a minimum period of six months. The results of the second oral examination will be considered final.

Fields of Specialization. The degree of Doctor of Musical Arts is offered in the area of Performance and Literature in the fields of Specialization of (1) Piano, and (2) Voice.

Curriculum. The exact amount and nature of course work to be undertaken by a candidate will be determined by the adviser with the approval of the Doctoral Committee in the light of the candidate's previous preparation and his field of specialization.

Residence. In general, the requirements for the degree of Doctor of Musical Arts contemplate at least three years of full-time graduate work. A minimum of 36 weeks is required in residence in full-time graduate study at West Virginia University beyond the Master's degree or its equivalent.

Recitals. The candidate shall give two formal public recitals of at least one hour performing time each, the first of which shall serve as part of his admission to candidacy. The programs must include literature composed before 1800 as well as nineteenth and twentieth-century music. The candidate must also complete two of the following options:

1. A chamber music program
2. A major role in a vocal chamber work
3. A concerto with orchestra
4. A major role in an opera
5. A major role in an oratorio
6. A lecture recital

All programs and performances must be approved by the Doctoral Committee.

Project of Advanced Study. The candidate shall complete a Project of Advanced Study dealing with some topic related to his field of performance—such as some aspect of performance practice, pedagogy, instrumental development, a segment of the literature, etc.—to be presented in a scholarly written form for acceptance by his Doctoral Committee.

Final Examination. If the candidate's Project and recitals are approved and he has fulfilled all other requirements, he will be admitted to the final oral examination before his Doctoral Committee. At the option of his Committee, a written examination may also be required. The final examination(s) shall be concerned with the Project of Advanced Study and the candidate's grasp of his field of specialization and its relation to other fields.

Time Limitation. Requirements for the degree of Doctor of Musical Arts must be completed within seven years of admission to candidacy.

THE DEGREE OF DOCTOR OF EDUCATION

The degree of Doctor of Education is offered in cooperation with the College of Human Resources and Education. The sequence of prerequisites to admission, prerequisites to candidacy, and requirements for the degree are set out in the Education section, page 178. The requirements for the degree of Doctor of Education for students in music are identical with those for students in education, except that, for students in music, a maximum of 24 semester hours of graduate work pursued in fulfillment of the requirements, for the Master's degree or its equivalent, if of suitable character and quality, may be credited toward the doctorate.

MUSIC

Applied Music

218. METHODS AND PEDAGOGY IN MAJOR APPLIED FIELDS. I. 1 hr. PR: Music 150.
219. METHODS AND PEDAGOGY IN MAJOR APPLIED FIELDS. II. 1 hr. PR: Music 218.
300. APPLIED MUSIC. I, II. 1-4 hr. Open to qualified students in any field in Applied Music. Course number may be repeated as many times as necessary or desirable. A student must demonstrate ability of grade-level 4 on an instrument to receive credit in Music 300 on that instrument. Students other than music majors may take a maximum of one 30-minute lesson per week at one hour credit

SECTION 28. I, II. 1 hr. Voice class for graduate students stressing fundamentals of voice production and pedagogy.

309. MASTER CLASS IN APPLIED REPERTOIRE. I, II. 2 hr. PR: Consent. A master class designed to give coverage through performance of the literature of a specific Applied Music field. Course may be repeated for credit; maximum credit 8 hours.

Conducting

310. CONDUCTING. I. 3 hr. PR: Music 184 or equiv. A graduate course in instrumental and choral conducting. Major works are prepared and conducted through the use of recordings and the large University music organizations.

311. CONDUCTING. 3 hr. PR: Music 310.

Literature

220. REPERTOIRE. I. 1 hr.

221. REPERTOIRE. II. 1 hr.

280. SURVEY OF OPERATIC MUSIC. I. 3 hr. PR: Music 141.

281. SURVEY OF SYMPHONIC MUSIC. II. 3 hr. PR: Music 141.

282. STUDIES IN CONTEMPORARY MUSIC. I. 3 hr. PR: Music 141.

283. SURVEY OF CHAMBER MUSIC. 3 hr. PR: Music 141.

284. COLLEGIUM MUSICUM. I, II. 0-2 hr. Performance of outstanding musical works not in the standard repertory. Although open as a performance group to upperclassmen, graduate students will select appropriate vocal and instrumental music, investigate modes of performance, prepare any necessary editions, and direct rehearsals under supervision. May be repeated for credit.

323. KEYBOARD LITERATURE. S. 3 hr. PR: Music 220. An intensive study of the literature for keyboard instruments and the history of the literature.

324. SONG LITERATURE. S. 3 hr. PR: Music 220. An intensive study of the Art Song and the Lied and the history of their development.

325. CHORAL LITERATURE. 3 hr. PR: Music 220. An intensive study of the body of choral music and the history of its development.

330. INTRODUCTION TO MUSICAL BIBLIOGRAPHY. I. 3 hr. PR: Music 140-141 or equivalent. A survey of important areas of musical bibliography with appropriate research assignments.

331. SEMINAR IN MUSICOLOGY. II. 3 hr. PR: Music 330. Musical research and investigation. Special fields of study will be selected for each term and individual projects undertaken. Course may be repeated for credit.

332. MUSIC IN THE MIDDLE AGES. I. 3 hr PR: Music 140-141 or equiv. and consent. A detailed study of the music and musical practice from the beginning of the Christian era to 1400.

333. MUSIC IN THE RENAISSANCE. II. 3 hr. PR: Music 140-141 or equiv. and consent. Continuation of Music 332 through the sixteenth century.

336. MUSIC IN THE BAROQUE PERIOD. I. 3 hr. PR: Music 140-141 or equiv. and consent. A detailed study of the music and musical practice of the period from 1600 to 1750.

337. MUSIC IN THE CLASSIC AND ROMANTIC PERIODS. II. 3 hr. PR: Music 140-141 or equiv. and consent. Continuation of Music 336 covering the period from 1750 to 1900.

338. HISTORY OF NOTATION. S. 3 hr. PR: Music 140-141 or equiv. A detailed study in transcribing the musical manuscripts of the Middle Ages.

339. HISTORY OF NOTATION. S. 3 hr. PR: Music 140-141 or equiv. Continuation of Music 338, covering the Renaissance Period.

Church Music

329. SURVEY OF SACRED MUSIC. S. 4 hr. PR: Music 140-141 or equiv. A study of music suitable to the liturgical year, including the historical background of the Jewish, Catholic, and Protestant liturgies.

Music Education

- 200. BAND, ORCHESTRA, CHORAL, OPERA THEATRE, AND MUSIC EDUCATION CLINICS. 2 hr. Special problems of organization and development of the various performing organizations. Lecture, laboratory, and discussion groups.
- 201. MUSIC IN THE ELEMENTARY SCHOOL. 2 hr. PR: Music 10, 11, 12, or consent. Development of skills, procedures, techniques, and materials used by the general classroom teacher of music in grades 1-8. Not open to music majors.
- 246. MUSIC IN THE JUNIOR HIGH SCHOOL. 2 hr. PR: Music 181-182 or equiv. A consideration of the potentialities and special needs of the junior high school in music education; programs, procedures, and materials.
- 340. CHORAL TECHNIQUES. II. 2 hr. PR: Music 181-182 or equiv. A study of advanced techniques and procedures involved in the development of ensembles.
- 342. INSTRUMENTAL TECHNIQUES I. 2 hr. PR: Music 181-182 or equiv. A study of advanced techniques and procedures involved in individual performance and instruction through lecture-demonstrations by the applied music faculty.
- 344. MUSIC EDUCATION. II. 3 hr. PR: Music 181-182 or equiv. Survey and critical study of the total music education program.
- 345. THE SUPERVISION OF MUSIC. 2 hr. PR: Music 181-182 or equiv. Problems in the supervision of music in the elementary grades and in junior high school.
- 346. INTRODUCTION TO RESEARCH IN MUSIC EDUCATION. I. 3 hr. PR: Music 181-182 or equiv. A study of various subjects and techniques of value in research in music education. Two lectures, one laboratory per week.
- 348. PSYCHOLOGY OF MUSIC LEARNING. II 3 hr. The application of learning theory to music learning; the nature of musical talent; music talent testing.
- 349. PSYCHOLOGY OF MUSIC. I. 3 hr. An introductory study of musical acoustics and psychology of perception of music.
- 351. MUSIC IN SOCIETY. 2 hr. PR: Music 141 or consent. The function throughout history of music in society; the relation between social factors and musical practice.
- 352. AESTHETICS OF MUSIC. II. 2 hr. PR: Music 141 or consent. An examination of the main classical and contemporary aesthetic theories and their applications to music.

Opera

- 210. OPERA THEATRE. I, II. 0-2 hr. Maximum credit 8 hr. PR: Music 20 or consent. Continuation of Music 20. Performance of major roles and advanced production techniques. Qualified students will undertake production-direction projects under supervision.

Theory and Composition

- 252. ANALYSIS OF MUSICAL FORM. I. 3 hr. PR: Music 4. A detailed study of the structure of music.
- 253. COUNTERPOINT. I. 2 hr. PR: Music 4 or consent. Sixteenth century counterpoint.
- 254. COUNTERPOINT. II. 2 hr. PR: Music 4. Eighteenth century counterpoint.
- 256. UPPER DIVISION COMPOSITION. I, II. 2 hr. PR: Four semesters Music 114, or consent based on scores submitted. Creative writing with emphasis on practical composition for performance. May be repeated for credit.
- 360. COMPOSITION. I, II. 3 hr. PR: Consent. A course primarily for candidates for the graduate degrees in Theory or Composition. Course may be repeated for credit; maximum credit 9 hours.
- 367. ANALYTICAL TECHNIQUES. I. 3 hr. A study of various theories of musical analysis and their application.

370. **ORCHESTRATION.** I, II. 2 hr. PR: Music 118 or equiv. Major projects of orchestration. Course may be repeated for credit; maximum credit 6 hours.

371. **COMPUTER APPLICATIONS IN MUSIC.** I. 3 hr. Computer programming and a survey of computer applications in music.

372. **BAND ARRANGING.** II. 2 hr. PR: Music 118 or equiv. Major projects in arranging for the concert band.

375. **PEDAGOGY OF THEORY.** II. 3 hr. PR: Music 4 and consent. Consideration of the various approaches to the teaching of theory.

381. **NONSERIAL TECHNIQUES OF 20TH CENTURY COMPOSITION.** I. 2 hr. A theoretical and analytical course including the application of various techniques in student compositions.

382. **SERIAL TECHNIQUES.** II. 2 hr. A theoretical and analytical course including the application of serial techniques in student compositions.

383. **REMEDIAL THEORY.** I, II. 0 hr. A course for graduate students who are deficient in undergraduate theory requirements.

Research or Recital

392. **ADVANCED STUDIES IN MUSIC.** I, II. 2-8 hr. PR: Consent of the instructor which in some cases may be contingent upon doctoral foreign language examinations. Primarily intended for Ph.D. candidates. Intensive individualized reading reported in group discussions. Course may be repeated as many times as necessary, in as many areas as needed, and several different sections (*i.e.*, areas) may be pursued simultaneously.

393. **RECITAL.** 2 hr. For Music Education majors only.

394. **DOCTORAL SEMINAR.** I, II. 2 hr. PR: Consent. Intensive individual investigation and preparation of research papers or compositions. Course may be repeated for credit; maximum credit 8 hours. Presented by the combined doctoral staff in music.

395. **DISSERTATIONAL GUIDANCE.** I, II. 1-12 hr. Credit not to be applied toward the Ph.D. or Ed.D.

396. **TWO LECTURE RECITALS.** 1-4 hr. For History of Music majors only.

397. **RESEARCH.** I, II. 1-15 hr. Research. The student may enroll in this course any number of times approved by his department and the graduate dean.

398. **RECITAL.** 1-4 hr. PR: Music 299 or equiv.

APPLIED MUSIC REQUIREMENTS*

MAJOR INSTRUMENT

Applied Music Majors. All entering graduate students majoring in Applied Music must demonstrate by audition grade-level 10 ability on their major instrument to be accepted for that degree.

Music Education, Theory, Composition, History of Music. All entering graduate students majoring in these areas must demonstrate by audition grade-level 7 ability on their major instrument, and to be eligible for graduation must demonstrate grade-level 8 ability.

Doctor of Philosophy. All entering graduate students for the Ph.D. must demonstrate performance ability on the major instrument to the satisfaction of the Admissions Committee.

PIANO

Music Education. All entering graduate students in Music Education must demonstrate Piano ability to satisfy either grade-level 2B or 3.

*Graduates of the Division of Music may enter on their past record of grade-level achievement without audition, unless it is deemed necessary by the Director of the Division of Music.

Theory, Composition. All entering graduate students majoring in these areas must demonstrate Piano ability to satisfy grade-level 4.

Applied Music, History of Music. All entering graduate students majoring in these areas must demonstrate Piano ability to satisfy grade-level 3.

COURSES IN APPLIED MUSIC†

CLASS PIANO — MUSIC 150 SECTIONS 30 TO 49

1A

Oxford Piano Course for Adult Beginner, Ada Richter; *Piano Course for the Older Beginner or Basic Piano*, Cheyette and Shake. Harmonization, transposition, and sight reading of simple melodies. Scales and arpeggios.

1B

Continuation of 1A.

2A

Second Solo Book, Diller-Quaile; *Young Pianists Library*, Denes Agay; *Library for Piano Students*, Frances Clark. Continuation of harmonization, transposition, and sight reading. Scales and arpeggios.

2B

Third Solo Book, Diller-Quaile; *Bach for Beginners*. Scales, all major and harmonic minors, hands together, 2 octaves, arpeggios. Sight reading four-part harmony, chord progressions. Ability to play familiar tunes with accompaniments.

PIANO — MUSIC 150 SECTION 09

PRIMARY PIANO A AND B

A choice from the following material: Thompson, *Teaching Little Fingers to Play*; Fletcher, *Music Lessons Have Begun*; Frances Clark Library, *Tune Time*, Book A & B, and *Technic Time*, Books A & B; Diller-Quaile, *First Solo Book*.

Technic—Major scales, to be played hands separately in quarter notes, one and two octaves, 4/4 time, M.M. quarter note = 88.

PIANO 1

Thompson, *First Grade Etudes*; Bentley, *Four and Twenty Melodies*; Frances Clark Library, *Piano Literature*, Book 1, and *Contemporary Literature*, Book 1; *Royal Conservatory of Toronto Method*, Grade 1; Frost, *The Adult at the Piano*, Books I and II.

Technic—All major scales, to be played hands separately in quarter and eighth notes, two octaves, 4/4 time, M.M. quarter notes = 92.

PIANO 2

Hirschberg, *Technic is Fun*; Czerny-Germer, *Studies*, Vol. 1, Part 1; Streabog, *Twelve Easy and Melodious Studies*; Terry, *Sunny Corner*; Bach-Carroll, *First Lessons in Bach*, Book 1; Frances Clark Library, *Piano Literature of 17th, 18th and 19th Centuries*, Book 2 and *Contemporary Literature*, Book 2; Bentley, *Summertime Sketches*; Gretchaninoff, *Children's Book*, Opus 98; Kabalevsky, *Twenty-four Pieces for Children*, Opus 39; Tansman, *Pour les Enfants*, Set 1.

Technic—All major and harmonic minor scales, to be played hands separately, M.M. quarter note = 96, as follows: One octave in quarter notes. Two octaves in eighth notes. Hands together in quarter notes.

Arpeggios—Diminished sevenths, to be played hands separately, M.M. quarter note = 88.

PIANO 3

Burgmuller, *Studies*, Opus 100; Bertini, *Studies*, Opus 100; Bach-Carroll, *First Lessons in Bach*, Book 1; Easy sonatinas by composers such as Beethoven, Clementi, Kuhlau, Mozart, etc. Suggested supplementary material: Bartok, *For Children*, Vols. I and II; Bloch, *Enfantines*; Prokofieff, *Music for Children*, Opus 65; *Meet Modern Music*, Parts 1 and 2; Schumann, *Album for the Young*.

†The material outlined in the various grade-levels is to be used as a guide and will vary with individual students. Students' grade-levels are based primarily on their technical and musical achievements.

Technic—All major, harmonic minor scales, to be played hands together, one octave apart, M.M. quarter note = 72, in the following forms: One octave in quarter notes. Two octaves in eighth notes. Three octaves in eighth notes (triplets). Four octaves in sixteenth notes.

Arpeggios—All diminished sevenths, and major and minor white key triad arpeggios, hands together to be played in similar patterns as scales, M.M. quarter note = 66.

PIANO — MUSIC 300 SECTION 09

PIANO 4

Bertini, *Studies*, Opus 29; Loeschhorn, *Studies*, Opus 66, 169, 170; Bach, *Two-part Inventions*, 18 *Little Preludes*; Bach-Carroll, *First Lessons in Bach*, Book 2; sonatinas and sonatas by composers such as Beethoven, Clementi, Haydn, Kuhlau, Mozart, etc.; Grieg, *Lyrical Pieces*, Opus 12; Transman, *Ten Diversions for the Young Pianist*.

Technic—All major and minor scales (harmonic and melodic) to be played hands together, M.M. quarter note = 80 in the following forms: One octave in quarter notes. Two octaves in eighth notes. Three octaves in eighth notes (triplets). Four octaves in sixteenth notes.

Arpeggios—All diminished sevenths, major and minor triads in inversions to be played in similar patterns as scales, M.M. quarter note = 72.

PIANO 5

Czerny, *School of Velocity*, Opus 299; Bach, *Two-Part Inventions*, 18 *Little Preludes and Fugues*, easier movements from suites; sonatas of appropriate difficulty by Beethoven, Haydn, and Mozart, such as Beethoven, Opus 49; Haydn, *Sonata in E minor*; Mozart, *Sonata in G major*, K. 283; Mendelssohn, *Songs Without Words*; Beethoven, *Six Variations on "Nel cor piu non mi sento"*; Debussy, easier Preludes.

Technic—All major and minor scales (harmonic and melodic) to be played in parallel motion, M.M. quarter note = 84. Major scales to be played in contrary motion, M.M. quarter note = 84.

Arpeggios—All diminished sevenths, major and minor triads to be played in inversions, M.M. quarter note = 76.

PIANO 6

Czerny, *School of Velocity*, Opus 299; Cramer, *Studies*; Bach, *Three Part Inventions*, easier Preludes and Fugues from the *Well-Tempered Clavier*; Sonatas by Haydn, Mozart, and Beethoven equivalent in difficulty to Opus 14, No. 1, Opus 10, No. 1 and Opus 79. Chopin, selected *Preludes* and *Mazurkas*; Schumann, *Forest Scenes*; Debussy, selected *Preludes* or material of similar difficulty.

Technic—All major scales to be played in parallel and contrary motion and in thirds and tenths, M.M. quarter note = 92. All minor scales to be played in parallel and contrary motion, M.M. quarter note = 92.

Arpeggios—All diminished sevenths, major and minor triads, and dominant sevenths to be played in inversions, M.M., quarter note = 84.

PIANO 7

Czerny, *Studies*, Opus 740; Clementi, *Gradus ad Parnassum*; Bach, *Three Part Inventions*, *Suites*, Preludes and Fugues from the *Well-Tempered Clavier*; Beethoven, Sonatas equivalent in difficulty to Opus 10 No. 3 and Opus 28; Romantic compositions such as Brahms—easier *Intermezzi* and *Capriccios*.

Technic—All major and minor scales in thirds, sixths, and tenths, and in parallel and contrary motion, M.M. quarter note = 100. Chromatic Scales.

Arpeggios—All major and minor triads, diminished and dominant sevenths in inversions, M.M. quarter note = 92.

PIANO 8

Clementi, *Gradus ad Parnassum*; Moszkowski, *Etudes*; Cramer, *Studies*; Bach, *Well-Tempered Clavier* and *Suites*; Beethoven, *Sonatas*, equivalent in difficulty to Opus 2, No 3, Opus 54, Opus 31; Concertos by Mozart or Mendelssohn; Romantic and modern compositions by Chopin, Schumann, Schubert, Debussy, Kabalevsky, etc.

Technic—All scales and arpeggios as in piano 7 with increased M.M. speeds.

PIANO 9

Bach, *Well-Tempered Clavier, Toccatas, Partitas*; Beethoven, *Sonatas* such as Opus 27; Chopin, *Etudes, Scherzi, Polonaises*; Schuman, *Papillons*. Easier works of Brahms, Liszt; Ravel, *Sonatine*; Contemporary compositions.

Technic—Same as in piano 8 with increased speeds.

PIANO 10

Chopin, *Etudes*; Bach, *Italian Concerto, Well-Tempered Clavier*; Beethoven, *Sonatas, Piano Concertos*; Brahms, *Rhapsodies* in g and b minor, pieces from Opus 76, 78, 116, 119; Chopin, *Ballades*; Debussy, *Preludes, Pour le Piano*; Bartok, *Suite Opus 14*; Hindemith, *Sonata No. 3*; Contemporary compositions.

Technic—Same as in piano 9.

GRADUATE

Chopin, Liszt, *Etudes*; Bach, *Chromatic Fantasy and Fugue*; Beethoven, *Late Sonatas* and Opus 53, 57; "Emperor" Concerto; Chopin, *Sonatas*; Brahms, pieces from Opus 116, 117, 118, 119, *Variations on a Theme by Handel, Variations on a Theme by Paganini, Concertos* in B flat major and d minor; Schumann, *Carnaval, Symphonic Etudes*; Ravel, *Toccata*; Prokofieff, *Sonata No. 7*; Barber, *Sonata, Opus 26*.

Technic—Same as in piano 10 plus scales in double octaves and double thirds.

PIPE ORGAN — MUSIC 300 SECTION 10

Students other than Applied Organ majors must demonstrate grade-level 4 in piano prior to studying Organ.

ORGAN 4

Bach—"Cathedral" *Prelude and Fugue, Fugue in D Minor*, selections from the *Liturgical Year*; Peeters—*Early Flemish Masters*; Mendelssohn—*Sonata in C Minor*; simple pieces by Sowerby, Willan and Bingham.

Technic—Pedal scales with hands in contrary motion. Hymn playing, transposition, simple anthem accompaniments.

ORGAN 5

Bach—*Little Fugue in G Minor, Prelude and Fugue in C Minor*, selections from the *Liturgical Year*; Bonnet (ed.)—selections from Volume 1 *Historical Recital Series*; Mendelssohn—*Prelude and Fugue in C Minor*; Franck—*Chorale in A Minor*; Langlais—*Nine Pieces*; selected slow movements from a Widor and a Vierne symphony.

Technic—Pedal scales with hands in contrary and parallel motion.

Hymn playing, transposition, anthem accompaniments of medium difficulty.

ORGAN 6

Bach—*Prelude and Fugue in F Minor, Toccata and Fugue in D Minor*, two *Schubler Chorales*; Bonnet (ed.)—Volume 1 *Historical Recital Series*; Mendelssohn—*Sonata in F Minor*; Franck—*Pièce Heroïque*; Brahms—*Chorale Preludes*; Pepping—*Kleines Orgelbuch*; contemporary compositions comparable in difficulty to Peeters—*Variations on an Original Theme Op. 58*.

Technic—continuation of Level 5.

Hymn playing, anthem accompaniments, playing portion of AGO test papers.

ORGAN 7

Bach—*Preludes and Fugues in A Minor and D Major, Trio Sonata 1*, selected *Chorales* from *Organ Mass*; selected works of Pachelbel; Mendelssohn—*Sonata in D Minor*; Franck—*Chorale in B Minor*; Widor—*Allegro* from *Sixth Symphony*; contemporary works by Walcha, Dupré, Langlais and Messiaen.

Hymn playing, anthem accompaniments, AGO test papers.

ORGAN 8

Bach—*Passacaglia and Fugue, Trio Sonata V, one Concerto, one of 18 Great Chorales*; selected works of Sweelinck; Liszt—*Prelude and Fugue on B-A-C-H*; Widor—*Theme and Variations from Fifth Symphony*; Vierne—*Symphony 1*; contemporary works comparable in difficulty to Dupré—*Cortege et Litanie*.

Hymn playing, oratorio accompaniments, AGO test papers.

ORGAN 9

Bach—*Preludes and Fugues* in E-flat and B Minor, *Trio Sonata III, Chorale Variation Vom Himmel Hoch*; selected works of Buxtehude; Reubke—*Sonata on 94th Psalm*; Handel—an organ *Concerto*; Hindemith—*Sonata 1*; contemporary works comparable in difficulty to Willan—*Introduction, Passacaglia and Fugue*.
Oratorio accompaniment.

ORGAN 10

Bach—selected major works comparable in difficulty to *Toccata in F*, one *Chorale Variation*, one of 18 *Great Chorales*; selected works of Frescobaldi; Handel—an organ *Concerto*; Selection from Bonnet (ed.)—Volume III *Historical Recital Series*; Vierne—*Second Symphony*; larger contemporary works comparable in difficulty to Dupre—*Variations on a Noël*.

Oratorio accompaniment.

VIOLIN — MUSIC 300 SECTION 17

VIOLIN 4

Studies: *School of Violin Technics, Part 1*, Schradieck; *Opus 38*, Dont; *Opus 1, Book 2*, Sevcik; *Opus 3*, Sevcik. Concerto: *Concerto in A minor*, Vivaldi. Compositions: *Rondino in E-flat major*, Beethoven-Kreisler; other solos of comparable difficulty.

Technic—Two octave major and minor scales and arpeggios. Various bowings and rhythms. One octave scales in double stops.

VIOLIN 5

Studies: *Opus 37*, Dont; *Opus 36, No. 1*, Mazas; *Bowing Studies*, Casorti; *School of Violin Technics, Part 1*, Schradieck. Concertos: *Concerto in G minor*, Vivaldi; *Concerto in D major*, Seitz; others of comparable difficulty. Sonatas: *Sonata No. 1 in D major*, *Sonata No. 3 in C major*, Corelli.

Technic—Selected three octave major and minor scales and arpeggios. Scales in double stops.

VIOLIN 6

Studies: *Opus 36*, Mazas; selected studies, Kreutzer; *Scale Studies*, Flesch; *School of Violin Technics, Part 2*, Schradieck. Concertos: *No. 2, No. 7, No. 9*, De Beriot; *No. 22*, Viotti; *E minor*, Nardini; others of comparable difficulty. Sonatas: Handel; Tartini.

Technic—All major and minor scales in three octaves, three forms of minor and chromatic using different time values and various bowings (staccato, spiccato, martele, detache). A more advanced skill in double stops, bowing combinations, octave passages, and other technical string devices.

VIOLIN 7

Studies: Kreutzer. Concertos: Kreutzer Rode, Viotti, Nardini, other concertos of comparable difficulty. Sonatas: Handel, Veracini. Compositions: *Romances*, Beethoven; Kreisler, orginal compositions and arrangements; other compositions of comparable difficulty.

Technic—*Scale Studies*, Flesch; *School of Violin Technics, Part 2, Part 3*, Schradieck.

VIOLIN 8

Studies: *Etudes*, Fiorillo; selected etudes, Rode. Concertos: *Concerto in A minor*, Bach; *Concerto in A major*, Bach; *Concerto in G major*, Mozart; *Concerto in D major*, Mozart; other concertos of comparable difficulty. Sonatas: Veracini; Mozart; *Solo Sonatas and Partitas* (selected movements), Bach. Compositions: *Praeludium and Allegro*, Kreisler; *La Folia*, Corelli; *Chaconne*, Vitali; other compositions of comparable difficulty.

Technic—*Scale Studies*, Flesch; *Opus 1, Book 3*, Sevcik.

VIOLIN 9

Studies: *Etudes*, Rode; *Etudes, Opus 19*, Alard. Concertos: *Concerto in A major*, Mozart; *Concerto No. 2*, Spohr; other concertos of comparable difficulty. Sonatas: Beethoven; *Solo Sonatas and Partitas*, Bach. Compositions: Kreisler, *Sicilienne and Rigaudon*; *Romanza Andaluza*, Sarasate; other compositions of comparable difficulty.

Technic—*Scale Studies*, Flesch. *Opus 1, Book 3* (continued), Sevcik.

VIOLIN 10

Studies: *Etudes*, Gaviniés; *Opus 35*, Dont; *Etudes*, *Opus 1*, Schradieck. Concertos: *Concerto in G minor*, Brück; *Concerto No. 9*, Spohr; *Concerto in E minor*, Mendelssohn; other concertos of comparable difficulty. Sonatas: Beethoven; *Sonata in A major*, Brahms; Piston; *Solo Sonatas and Partitas*, Bach. Compositions: Representative compositions of 19th and 20th century composers. Student should have an extensive knowledge of violin literature, including the works of Corelli, Tartini, Bach, Mozart, Beethoven, Wieniawski, Viotti, Rode, Kreutzer, Vieuxtemps, Saint-Saëns, and representative works of 20th century composers.

Technic—*Scale Studies*, Flesch; *Opus 1, Book 4*, Sevcik.

VIOLA — MUSIC 300 SECTION 16

VIOLA 4

Studies: 40 *Studies*, Bruni; *Student Concerto No. 3*; Seitz; *Divertimento*, Haydn-Piatigorsky.

Technic—Two octave major and minor scales and arpeggios. Various bowings and rhythms. One octave scales in double stops.

VIOLA 5

Studies: *Opus 36, Book 1*, Mazas; *Concerto in G Minor*, Telemann; *Sonata in F Major*, Marcello.

Technic—Selected three octave scales, major and minor, and arpeggios. Scales in double stops.

VIOLA 6

Studies: *Opus 36*, Mazas; *Selected Studies*, Kreutzer; *Concerto*, Hoffmeister; *Sonatas*, Corelli, Handel.

Technic—All major and minor scales in three octaves, three forms of minor and chromatic using different time values and various bowings (staccato, spiccato, martele, détache). A more advanced skill in double stops, bowing combinations, octave passages, and other technical string devices.

VIOLA 7

Studies: 42 *Studies*, Kreutzer; *Caprices*, Campagnoli, *Sonatas for Viola Da Gamba*, Bach; *Concerto in D Major*, *Opus 1*, Stamitz. Other solos of comparable difficulty.

Technic—*Scale Studies*, Flesch.

VIOLA 8

Studies: Fiorillo; *Selected Studies*, Rode; *Unaccompanied Cello Suites*, Bach; *Sonata in A Major, No. 6*, Boccherini; *La Folia*, Corelli.

Technic—*Scale Studies*, Flesch.

VIOLA 9

Studies: *Etudes*, Rode; *Twelve Caprices*, L. Fuchs; *Arpeggione Sonata*, Schubert; *Sonatas*, Brahms.

Technic—*Scale Studies*, Flesch.

VIOLA 10

Studies: *Etudes*, Gaviniés; *Opus 35*, Dont; *Sonata*, *Opus 11, No. 4*, Hindemith; *Concerto*, Walton.

Technic—*Scale Studies*, Flesch.

VIOLONCELLO — MUSIC 300 SECTION 03

VIOLONCELLO 4

Continuing emphasis on good intonation, and improved sound production with addition of vibrato. Continued drill in first four positions, both extended and regular, and shifting. Introduction of 5th, 6th, and 7th positions. Etudes: Work of difficulty of Alwin Schroeder, 170 *Foundation Studies*, Vol. I; or 113 *Studies for Violoncello*, Vol. I, Dotzauer. Introduction of Sonatas (Handel, Marcello, Vivaldi) as well as continuing use of short pieces of more difficult nature.

Technic—Scales, major and minor, two octaves, all positions through 7th. Emphasis on shifting as well as improved sound production. Various bowings and rhythmic patterns.

VIOLONCELLO 5

Continuing work with vibrato, developing improved sound production. Development of musical expressiveness and awareness. Introduction of various bowings—bouncing bow, detache, staccato, etc. Introduction of thumb position. Etudes: Continuing use of Schroeder and Dotzauer Studies. Sonatas by Vivaldi (E minor), Marcello (F major) or works of similar difficulty. Short works of comparable difficulty.

VIOLONCELLO 6

Continuing development of good sound production along with development of dexterity of bow and left hand. Development of musical expressiveness and comprehension of differences in style through sonatas and pieces of virtuoso character. Thumb position continued. Etudes: Continued use of studies of comparable difficulty to *Studies (Book II)*, Schroeder; or *Studies (Book II)*, Dotzauer. Short pieces of increasing difficulty. Sonatas by Vivaldi, Telemann, Marcello, Eccles (G minor). Concertos of difficulty of Goultermann No. 4 in G.

Technic—Scales and arpeggios in three octaves, various bowings and rhythmic patterns. Introduction of scales in thirds and octaves, involving thumb positions.

VIOLONCELLO 7

Development of technical security in all positions. Development of musical insight and conception of varying styles. Continuing development of sight-reading technique. Etudes: Work of difficulty of *Studies*, Books II and III, Schroeder; and *Twenty-one Etudes*, Book I, Duport. Sonatas by Brahms (E minor), Vivaldi, unaccompanied suite by Bach (G major or D minor) or works of similar difficulty; *Symphonic Variations*, Boellmann; or work of similar difficulty.

Technic—Scales and arpeggios in three octaves. Various bowings and rhythmic patterns. Octaves and thirds in all positions.

VIOLONCELLO 8

Continued development of technical skill through major and minor scales (three and four octaves, various bowings and rhythmic patterns, thirds and octaves, thumb position), arpeggios, and etudes to be chosen from Schroeder, Duport, Such, Popper (*High School of Cello Playing, Opus 73*). Sonatas by Beethoven Opus 5, Brahms, Vivaldi, Boccherini or other works of comparable difficulty. Bach *Suites* (No. 2 or 3). Concerto or concert-piece by Goltermann, Klengel, d'Albert, Faure *Elegy* or works of similar difficulty.

VIOLONCELLO 9

Continuation of scales and etudes outlined in Violoncello 8. Sonatas by Beethoven (No. 2 and 3), Bach, Boccherini; *Solo Suites* (No. 4 or 5) Bach; *Variations*, Beethoven; or works of similar difficulty. *Concerto* by Lalo, Boccherini; concert-piece by Dohnanyi or works of similar difficulty.

VIOLONCELLO 10

All scales, major and minor, four octaves. Arpeggios, three octaves. Scales in thumb position. Scales and arpeggios in various bowing, rhythmic patterns and fingerings. Etudes by Popper, Dotzauer, Duport, Piatti, Franchomme. Representative works from Classic, Romantic, Impressionistic, and Contemporary periods. Concerto to be played should be memorized and of the difficulty of Saint-Saens *Concerto in A Minor*. Sonata from Romantic Period of difficulty of *Sonata in F Major*, Brahms.

STRING BASS — MUSIC 300 SECTION 12

STRING BASS 4

Moderately easy solo material such as transcriptions of first position cello solos, Schlemueller, W. H. Squire, Popejoy, and others.

Technic—Major and minor scales and arpeggios with various bowing techniques up to and including 5th position; development of the full arm vibrato; further development of tone production, intonation, and shifting in the study of such materials as the *New Method for Double Bass*, Book 1, Simandl; *Tutor*, Langely; *Method of Bass*, Book 2, Butler.

STRING BASS 5

Study of material from books and methods of the intermediate grade such as *Sixty-Six Etudes*, Slama.

Medium easy solo literature such as *Intermezzo*, Vivaldi, and selected works from Zimmerman's transcriptions. Continuation in development of good sound, intonation, musicianship in the intermediate grades.

Technic—Major and minor scales and arpeggios with various bowings and rhythms up to and including 6th position with emphasis on proper use of left hand fingers in shifting between all positions in this range.

STRING BASS 6

Study material: *Method Book 1*, Simandl; *Double Bass Studies*, Madenski; 30 *Studies for Double Bass*, Moleaux.

Solo literature of medium difficulty such as found in the 34 *String Bass Solos* arranged by Lesinsky.

Technic—Continued drill in proper fingering and shifting between all positions up to and including 7th position; major and minor scales and arpeggios within that range using various bowing techniques with continued emphasis on good tone production, intonation, and an awareness of differences in musical styles.

STRING BASS 7

Study materials: *Etudes* by Simandl, Hrabe, Storch, and others as well as orchestral literature through such collections of excerpts as those by Reynolds and Strauss. *Bass Methods Book II-III*.

Medium difficult solo literature by Faure, Pergolesi, Hindemith; sonata and concerto literature borrowed from easy sonatas and student concertos such as *C Major Sonata*, Breval; *Concerto Opus 17*, Grant.

Technic—Major and minor scales and arpeggios through two octaves; continued technique development as set forth in levels 4, 5, and 6 above.

STRING BASS 8

Study materials selected from intermediate through advanced grades to suit the needs of the individual student.

Solo material selected from available bass literature supplemented with sonata and concerto literature borrowed from moderately difficult to difficult cello works.

Technic—Introduction of thumb position; development of security and precision of fingering in all positions up to and including 7th position.

STRING BASS 9

Solo material to be selected from advanced works for bass and transcriptions from cello literature to lead student to a sensitive expressiveness and an understanding of musicianship.

Technic—Further drills and studies in thumb position; completion of major and minor scales and arpeggios in rhythmic and bowing patterns throughout range up to 12th position. Continuation of *Etude* studies and orchestral excerpts.

STRING BASS 10

Solo material to be selected from advanced to virtuoso levels or repertory available and suited to the needs of the student at the discretion of the instructor.

Technic—Completion of representative materials presented in standard Book II methods to bring student to his highest level of development in use of details of procedure which are essential to expertness of execution, in musicianship, and in performing artistically.

FLUTE — MUSIC 300 SECTION 05

FLUTE 4

Etudes: *Melodious and Progressive Studies*, Book 1, ed. Cavally; 18 *Exercises*, Berbiguier. Literature: *Twenty-four Short Concert Pieces*, ed. Cavally; *Concert and Contest Collection*, ed. Voxman.

Technic—Major and harmonic minor scales, major and minor triads—2 octaves, 16th notes.

FLUTE 5

Etudes: *Melodious and Progressive Studies*, Book 2, ed. Cavally; *Selected Studies*, ed. Voxman; *Grand Exercises Journaliers de Mecanisme*, Taffanel and Gaubert. Literature: *Sonatas*, Loeillet; *Duets*, Kuhlau; *Twenty-four Short Concert Pieces*, ed. Cavally.

Technic—Major and melodic minor scales, chromatic and whole-tone scales, major and minor triads; dominant-7th chords, extended range, varied articulations.

FLUTE 6

Etudes: 24 *Etudes*, Opus 33, Andersen; 24 *Melodious Studies*, Opus 37, Boehm; 24 *Concert Studies from J. S. Bach*, arr. Schindler; *Grand Exercise Journaliers de Mecanisme*, Taffanel and Gaubert Literature: *Sonatas*, Handel; *Syrinx*, Debussy; *Duets*, Kuhlau; *Scherzino*, Andersen; *Serenade*, Hue.

Technic—Scales in continuous patterns; major, minor, augmented triads; dominant-7th and diminished-7th arpeggios.

FLUTE 7

Etudes: *Etudes*, Opus 30, Andersen; 24 *Caprices*, Opus 26, Boehm. Literature: *Sonatas*, Bach and Handel; *Sonatas*, Telemann and Vivaldi; *Suites* and *Concertos*, Telemann and Vivaldi; *Andante in C*, Mozart.

Technic—Scales in thirds and sixths; arpeggios continued at increased speed.

FLUTE 8

Etudes: 24 *Etudes Artistique*, Opus 15, Andersen; 6 *Divertissements*, Opus 68, Kuhlau. Literature: *Sonatas*, Bach; *Concertos in G and D*, Mozart; *Piece for Flute Alone*, Ibert; *Nocturne et Allegro Scherzando*, Gaubert; *Airs de Ballet from "Ascanio,"* Saint-Saëns (Taffanel). Orchestral studies.

Technic—"Daily Scale and Arpeggio Routine"—Major scale, I triad, I 7th, diminished-7th on raised I, II 7th, V 7th, 2-octave chromatic scale on I, relative minor scale, minor I triad, minor V 7th.

FLUTE 9

Etudes: *Etudes et Exercises Techniques*, Moyse; *De la Sonorite*, Moyse; *Etudes*, Opus 63, Andersen. Literature: *Sonata*, Hindemith; *Night Soliloquy*, Kennan; *Fantasia*, Faure; modern solo material. Orchestral studies.

FLUTE 10

Etudes: *Virtuoso Studies*, Opus 60, Andersen; 30 *Caprices*, Opus 107, Karg-Elert; studies from the works of Moyse. Literature: *Poem*, Griffes; *Sonata*, Piston; *Sonata*, Prokofieff; other works from the modern repertoire.

OBOE — MUSIC 300 SECTION 07

OBOE 4

Studies: Barret, *Progressive Studies*; Bleuzet, *Technique of the Oboe*, Vol. I. Solos: Schumann, *Three Romances*.

Technic—Continuation of range extension, increase of flexibility and velocity, tone coloring, articulations. Reed making. Major and minor scales in pattern form: to 6 $\#$, 6b.

OBOE 5

Studies: Barret, *Complete Oboe Method* (Sonatas); Bleuzet, *Technique of the Oboe*, Vol. I.

Solos: Handel, *Sonatas #1 and 2*.

Technic—Continuation of flexibility and velocity, varied articulations. Major and minor scales in pattern form, I triad, V7 arpeggio.

OBOE 6

Studies: Barret, *Sonatas*; Bleuzet, *Technique of the Oboe*, Vol. I.

Solos: Hindemith, *Sonata*.

Technic—Flexibility and velocity, varied articulations. Major and minor scales. I triad, V7 arpeggio.

OBOE 7

Studies: Ferling, 48 *Etudes*; Bleuzet, *Technique of the Oboe*, Vol. II.

Solos: Handel, *Concerto in G Minor*.

Technic—Advanced technique. Major and minor scales in thirds and fourths, all articulations.

OBOE 8

Studies: Ferling, 48 *Etudes*; Bleuzet, *Technique of the Oboe*, Vol. II.

Solos: Marcello, *Concerto*.

Technic—Continuation of advanced technique. Major and minor scales in thirds and fourths, all articulations.

OBOE 9

Studies: Bleuzet, *Technique of the Oboe*, Vols. I, II, III; Andraud, *Vade Mecum*. Solos: Mozart, *Concerto in C Major*.

Technic—Basic review of previous levels, all techniques, scales, intervals, arpeggios. Orchestral studies.

OBOE 10

Studies: Bleuzet, *Technique of the Oboe*, Vols. I, II, III; Andraud, *Vade Mecum*.

Solos: Goosens, *Concerto*.

Technic—Specialized technique. All techniques, scales, intervals, arpeggios. Orchestral studies.

CLARINET — MUSIC 300 SECTION 04

CLARINET 4

Etudes: Studies in tone and phrasing from *Thirty-two Studies*, Rose. Literature: *Concert and Contest Collection*, Voxman: *Ballade*, Gade; *Romance*, Becker; *Chanson*, Gliere.

Technic—Major and harmonic minor scales, major and minor triads—2 octaves, 16th notes.

CLARINET 5

Etudes: Studies in articulation and execution from *Thirty-two Studies*, Rose. Literature: *Concert and Contest Collection*, Voxman: *Scherzo*, Koepke; *Adagio from Concerto*, K. 622, Mozart; *Fantasy-Piece*, No. 1, Schumann.

Technic—Major and melodic minor scales, chromatic and whole-tone scales, major and minor triads, dominant-seventh chords—extended range, varied articulations.

CLARINET 6

Etudes: *Forty Studies*, Book 1, Rose; *Method for Clarinet*, Part 3A (*Virtuoso Studies*), Langenus. Literature: *Promenade*, Delmas; *Allegretto grazioso* from *Sonata No. 1, Allegro appassionata* from *Sonata No. 2*, Brahms; *Canzonetta*, Opus 19, Pierie; *Sonatine*, Weinberger.

Technic—Scales in continuous patterns; major, minor, augmented triads; dominant 7th and diminished 7th arpeggios.

CLARINET 7

Etudes: *Forty Studies*, Book 2, Rose; *24 Studies in All Keys*, Stark; *Bach for the Clarinet*, Part 2 (ed. Simon). Literature: *Fantasia and Rondo*, Weber; *Sonata*, Mendelssohn; *Five Bagatelles*, Finzi; *Lyrical Piece*, Barlow; *Sonata*, Hindemith.

Technic—Scales in thirds and sixths, arpeggios continued at increased speed.

CLARINET 8

Etudes: *Twenty Studies after Rode*, Rose; *Twenty-five Etudes de Technique*, Jeanjean; *Thirty Studies after Bach*, Handel, Dont, etc., Perier. Literature: *Concertino*, Weber; *Sonata in E flat*, Opus 167, Saint-Saens; *Andante et Scherzo*, Pierie; *Duo Concertante*, Weber.

Technic—"Daily Scale and Arpeggio Routine"—Major scale, I triad, I 7th, diminished—7th on raised I, II 7th, V 7th, 2-octave chromatic scale on I, relative minor scale, minor I triad, minor V 7th.

CLARINET 9

Etudes: *18 Etudes de Perfectionnement*, Jeanjean; *Twenty-two Studies in the Modern Style*, Perier. Literature: *Concerto*, K. 622, Mozart; *Three Fantasy-Pieces*, Opus 73, Schumann; *Three Pieces for Clarinet Solo*, Stravinsky. Orchestra studies: Mozart, Beethoven, Weber, Mendelssohn, Schumann, Berlioz.

CLARINET 10

Etudes: *Sixteen Studies in the Modern Style*, Jeanjean; *Twenty-two Studies in the Modern Style*, Perier. Literature: *Sonatas*, Brahms; *Premiere Rhapsody*, Debussy; *Canegril*, Opus 72, Busser; *Duo concertante*, Milhaud. Orchestra studies: Wagner, Strauss, Rimsky-Korsakoff, 20th-century works.

BASSOON — MUSIC 300 SECTION 02

BASSOON 4

Studies: Weissenborn, *Bassoon Studies*, Book II; Jancourt, 38 *Progressive Exercises*; Oubradous, *Daily Scales and Exercises*, Book I.

Solos: Pierne, *Solo de Concert*; Galliard, *Six Sonatas*.

Technic—Continued increase of range, exercises in rhythm and articulation, tenor clef study. Reed making. Major and minor scales to 6#, 6b, I triad.

BASSOON 5

Studies: Jancourt, 26 *Melodic Studies*; Oubradous, *Daily Scales and Exercises*, Book II.

Solos: Telemann, *Sonata in F Minor*; Hindemith, *Sonata*.

Technic—Increased velocity and flexibility, increased range, varied articulation. Major and minor scales in thirds and fourths, I triad, V7 arpeggio: to 3#, 3b.

BASSOON 6

Studies: Jancourt, 26 *Melodic Studies*; Oubradous, *Daily Scales and Exercises*, Book II.

Solos: con Weber, *Concerto in F Major*; Vivaldi, *Concerto in Bb (La Notte)*.

Technic—Continuation of velocity and flexibility studies, varied articulation, increase of range. Major and minor scales in thirds and fourths, I triad, V7 arpeggio: to 6#, 6b.

BASSOON 7

Studies: Milde, 25 *Studies in All Keys*; Milde, *Concert Studies*, Book I, or Orefici, *Studi Melodici*.

Solos: Mozart, *Concerto*, K. 191; Phillips, *Concert Piece*.

Technic—Advanced technique. Scales and arpeggios in all keys.

BASSOON 8

Studies: Milde, 25 *Studies in All Keys*; Milde, *Concert Studies*, Book I, or Orefici, *Studi Melodici*.

Solos: Bach, *Cello Suites*; Vivaldi, *Concerto in A Minor*, F.VII, n.2.

Technic—Advanced technique. Scales and arpeggios in all keys.

BASSOON 9

Studies: Milde, *Concert Studies*, Book II; Piard, *Scale Studies*, Book I.

Solos: Kohs, *Sonatina*; Vivaldi, *Concerto in A Minor*, F.VII, n.7.

Technic—Basic review of previous levels. Scale studies in all keys. Orchestral studies.

BASSOON 10

Studies: Milde, *Concert Studies*, Book II; Piard, *Scale Studies*, Book I.

Solos: Jacob, *Concerto*; Bozza, *Concertino*.

Technic—Study and analysis of different styles of execution relative to various composers. Scales in all keys. Orchestral studies.

SAXOPHONE — MUSIC 300 SECTION 11

SAXOPHONE 4

Studies: Blement, 22 *Melodic Studies*, Book I. Busser, 12 *Melodic Etudes*.

Solos: Gershwin, *Prelude #2*; Bozza, *Aria*; Franck, *Pièce II*.

Technic—Continuation of flexibility and velocity, articulation, dynamics. Major and minor scales, 8th notes, I triad: to 6#, 6b.

SAXOPHONE 5

Studies: Mule, 18 *Studies After Berbiguier*.

Solos: Lantier, *Sicilienne*; Milhaud, *Danse*.

Technic—Continuation of flexibility and velocity, vibrato study, varied articulation. Major and minor scales, 16th notes, I triad, V7 arpeggio, varied articulation: to 3#, 3b.

SAXOPHONE 6

Studies: Mule, 18 *Studies After Berbiguier*.

Solos: Ibert, *Aria*; Eccles, *Sonata*.

Technic—Flexibility and velocity study, vibrato study, articulation. Major and minor scales, 16th notes, I triad, V7 arpeggio: to 6 \sharp , 6b.

SAXOPHONE 7

Studies: Mule, *Scale Studies*, Book I; Mule, *Daily Studies After Terschak*; Mule, 48 *Studies After Ferling*.

Solos: Heiden, *Sonata*; Rameau, *Rigaudon*.

Technic—Advanced technique. Scales, I triad, V7 arpeggio, in all keys.

SAXOPHONE 8

Studies: Mule, *Scale Studies*, Book I; Mule, *Daily Studies After Terschak*; Mule, 48 *Studies After Ferling*.

Solos: Creston, *Sonata*; Schmitt, *Legende*.

Technic—Advanced technique. Scales, I triad, V7 arpeggio, in all keys.

SAXOPHONE 9

Studies: Mule, 52 *Studies After Boehm, Terschak, and Furstenau*; Mule, 30 *Studies After Soussman; Viola, Saxophone Method*.

Solos: Glazounov-Petiot, *Concerto*; Creston, *Concerto*.

Technic—Specialized technique. Basic review of previous levels.

SAXOPHONE 10

Studies: Mule, 52 *Studies After Boehm, Terschak, and Furstenau*; Mule, 30 *Studies After Soussman; Viola, Saxophone Method*.

Solos: Ibert, *Concerto da Camera*; Tcherepnine, *Sonatine Sportiv*; Bonneau, *Caprice en Forme de Valse*.

Technic—Specialized technique. Study and analysis of different styles of execution relative to various composers.

FRENCH HORN — MUSIC 300 SECTION 06

FRENCH HORN 4

Begin E transposition. Continuation of French Horn 3.

Typical material—Studies: Schantl-Pottag, *Preparatory Melodies to Solo Playing*; C. Kopprasch, 60 *Studies*, Book 1; E. Gates, *Odd-Meter Etudes*.

Solos: F. Danzi, *Sonata in E flat*, op. 28; F. Rosetti, *Concerto in d minor*; Mozart, *Concerto No. 3*.

Technic—All major and minor scales and straight arpeggios, one and two octaves, in simple and compound rhythm patterns, M.M. quarter note = 72.

FRENCH HORN 5

A review of all the fundamentals of horn playing. Work on double tonguing and lip trills. Begin D and G transposition.

Typical material—Studies: Maxime-Alphonse, 200 *Studies*, Book 1; C. Kopprasch, 60 *Studies*, Book 2; J. F. Gallay, 28 *Studies*, op. 13; Pottag-Andraud, *Selected Melodious, Progressive and Technical Studies*, Book 1.

Solos: F. Akemenko, *Melody*; R. Gliere, *Intermezzo*; A. Scriabin, *Romance*; Mozart, *Concerto No. 1*.

Technic—All major and minor scales, the same as French Horn 4, plus in diatonic pattern, all at M.M. quarter note = 72.

FRENCH HORN 6

Add C transposition. Begin work on triple tonguing. Begin study of orchestral literature.

Typical material—Studies: Maxime-Alphonse, 200 *Studies*, Book 2; Pottag-Andraud, *Selected Melodious, Progressive and Technical Studies*, Book 2; J. F. Gallay 12 *Studies*, op. 57.

Solos: E. Chabrier, *Larghetto*; R. Gliere, *Nocturnes*; Mozart, *Concerto No. 2*.

Technic—Scales as in French Horn 5 with increased speeds, plus quintuplet grouping. Arpeggios as in French Horn 4, plus augmented, dominant seventh and diminished seventh.

FRENCH HORN 7

Transposition in D flat. Continuation of study of orchestral literature. Emphasis on solo literature. Study of methods and materials used in private horn instruction.

Typical material—Studies: Maxime-Alphonse, 200 *Etudes*, Book 3.

Solos: A. Glazounov, *Reverie*; Mozart, *Concerto No. 4*; Mozart, *Concert Rondo*; A. Cooke, *Rondo*.

Technic—Same as in French Horn 6 with increased speeds.

FRENCH HORN 8

Transposition in B flat and B natural. Continuation of French Horn 7.

Typical material—Studies: Maxime-Alphonse, 200 *Etudes*, Book 4; J. F. Gallay, 39 *Preludes*, op. 27.

Solos: Haydn, *Concerto No. 2*; B. Heiden, *Sonata*; H. Busser, *Concert Piece*.

Technic—Same as in French Horn 7 with increased speeds.

FRENCH HORN 9

Transposition in A flat and A natural. Comprehensive study of solo literature and orchestral horn solos.

Typical material—Studies: Maxime-Alphonse, 200 *Etudes*, Book 5; J. F. Gallay, 12 *Grand Caprices*.

Solos: P. Dukas, *Villonelle*; Beethoven, *Sonata*; Saint-Saens, *Morceau de Concert*.

Technic—Same as in French Horn 8 with increased speeds.

FRENCH HORN 10

All transpositions. A coverage of all types of styles and techniques used in solo, orchestral and chamber music. Memorization of standard orchestral excerpts and selected recital pieces.

Typical material—Studies: Maxime-Alphonse, 200 *Etudes*, Book 6; J. F. Gallay, *Grandes Etudes Brillantes*, op. 43.

Solos: R. Schumann, *Adagio and Allegro*; P. Hindemith, *Sonata*; Haydn, *Concerto No. 1*; R. Strauss, *Concertos*.

Technic—Same as in French Horn 9 with increased speeds.

TRUMPET — MUSIC 300 SECTION 14

TRUMPET 4

Continued refinements of concepts in Level 3. Work on double and triple tonguing.

Typical material—Studies: H. Clark, *Technical Studies*; Duhem, 24 *Etudes*; E. Gates, *Odd Meter Etudes*.

Solos: C. Bond, *Concerto*; A. Petit, *Etude de Concours*; W. Eckard, 12 *Program Solos*.

Technic—All major and minor scales and straight arpeggios, one or two octaves, in simple and compound rhythm patterns, M.M. quarter note = 72.

TRUMPET 5

A review of all the fundamentals of trumpet playing. Introduction to C, D, and A transpositions.

Typical materials—Studies: E. Goldman, *Practical Studies*; Sachse, 100 *Etudes*; M. Schlossberg, *Daily Drills*; H. Voxman, *Selected Studies*.

Solos: A. Corelli, *Sonata 8*; Fitzgerald, *Modern Suite*; A. Goedicke, *Concert Etude*.

Technic—All major and minor scales, same as level 4, plus in diatonic pattern, all at M.M. quarter note = 84. Major and minor arpeggios in straight and broken form at M.M. quarter note = 72.

TRUMPET 6

Further development of range and flexibility. Addition of A flat, E flat, B, and F transpositions. Work on improvisation.

Typical material—Studies: J. Arban, *Characteristic Studies*; Gisondi, *Bach for the Trumpet*; R. Laurent, *Etudes Pratiques*, Vol. 1 and 2.

Solos: E. Bozza, *Badinage*; W. Hartley, *Sonatina*; Webber, *Suite in F Major*.

Technic—Scales as in Level 5 with increased speeds, plus quintuplet grouping. Arpeggios as in Level 5, plus augmented, dominant seventh, and diminished seventh.

TRUMPET 7

Addition of G and E transpositions.
Typical material—Studies: V. Brandt, 34 *Studies*; H. Glantz, 48 *Studies*; R. Laurent, *Etudes Pratiques*, Vol. 3.
Solos: Haydn, *Concerto*; W. Latham, *Suite*.
Technic—Same as in Trumpet 6 with increased speeds.

TRUMPET 8

Study of the C trumpet. Added emphasis upon orchestral literature.
Typical material—Studies: G. Bartold, *Orchestral Excerpts*, Book 1, 2, 3; T. Charlier, 36 *Etudes*; R. Sabarich, 10 *Etudes*.
Solos: J. Hummel, *Concerto*; K. Riisager, *Concertino*.
Technic—Same as Level 7 with increased speeds.

TRUMPET 9

Continued stress of orchestral and solo repertoire.
Typical material—Studies: G. Bartold, *Orchestral Excerpts*, Books 4 and 5; V. Brandt, *Last Etudes*; M. Broiles, *Studies and Duets*, Vol. 2.
Solos: P. Hindemith, *Sonata*; K. Kennan, *Sonata*.
Technic—Same as Level 8 with increased speeds.

TRUMPET 10

Review of all techniques and styles for solo, orchestral, and ensemble playing.
Memorization of standard orchestral excerpts and selected recital pieces.
Typical material—Studies: M. Bitsch, 20 *Etudes*; C. Chaynes, 15 *Etudes*; Rossbach, Strauss *Orchestral Excerpts*; Hoehne, *Wagner Orchestral Excerpts*, Vol. 1 and 2.
Solos: Wal-Berg, *Concerto*; J. Addison, *Concerto*; G. Enesco, *Legend*.
Technic—Same as Level 9 with increased speeds.

TROMBONE — MUSIC 300 SECTION 13

TROMBONE 4

Further development of range, tone control, breathing, flexibility and articulation.
Work on double and triple tonguing. Introduction of tenor clef.
Typical material—Studies: R. Fink, *Introduction to the Tenor Clef*; J. Rochut, *Melodious Etudes*, Vol. 1; continuation of A. Slama, 66 *Etudes*.
Solos: Haydn, *Adagio*; J. Galliard, 6 *Sonatas for Bassoon*; A. Guilmant, *Morceau Symphonique*; H. Berlioz, *Recitative and Prayer*; Croce-Spinelli, *Solo de Concours*.
Technic—All major and minor scales and straight arpeggios, one or two octaves, in simple and compound rhythm patterns, M.M. quarter note = 72.

TROMBONE 5

A review of all the fundamentals of trombone playing. Advanced flexibility exercises. Introduction of B flat treble clef transposition.
Typical material—Studies: E. Gates, *Odd Meter Etudes for All Instruments in Treble Clef*; O. Blume, 36 *Studies*; continuation of J. Rochut, *Melodious Etudes*, Vol. 1; H. Voxman, *Selected Studies*; B. Gregoriev, 78 *Studies*.
Solos: J. E. Barat, *Andante and Allegro*; V. Blazhevich, *Concert Piece Number 5*; Vivaldi, *Sonatas for 'Cello*.

Technic—All major and minor scales, same as Level 4, plus in diatonic pattern, all at M.M. quarter note = 84. Major and minor arpeggios in straight and broken form at M.M. quarter note = 72.

TROMBONE 6

Work in improvisation. Introduction of alto clef. Further development of range and flexibility.

Typical material—Studies: R. Mueller, *School for the Trombone*, Vol. 3; C. Kopprasch, 60 *Studies*; J. Rochut, *Melodious Etudes*, Vol. 2; V. Blazhevich, *Clef Studies*; C. Colin, *Progressive Techniques*; A. LaFosse, *School of Sight Reading and Style*, Book 1.

Solos: Handel, *Concerto*; Saint-Saens, *Cavatine*; A. Corelli, *Sonatas for 'Cello*.

Technic—Scales as in Level 5 with increased speeds, plus quintuplet grouping. Arpeggios as in Level 5, plus augmented, dominant seventh and diminished seventh.

TROMBONE 7

A study of the more advanced material with emphasis on recital literature. Introduction to the bass trombone.

Typical material—Studies: O. Blume (R. Fink), 36 *Studies for Trombone with "F" Attachment*; K. Kahila, *Advanced Studies*; continuation of V. Blazhevich, *Clef Studies*; continuation of J. Rochut, *Melodious Etudes*, Vol. 2; continuation of A. LaFosse, *School of Sight Reading and Style*.

Solos: P. Vidal, *Second Concert Piece*; P. McCarty, *Sonatina for Bass Trombone*; R. Sanders, *Sonata in E Flat*; L. Bernstein, *Elegy for Mippy II*.

Technic—Same as in Trombone 6 with increased speeds.

TROMBONE 8

Further emphasis on clef reading and solos. Begin study of the standard orchestral repertoire.

Typical material—Studies: A. Ostrander (ed.), *Orchestra Passages for Trombone*; V. Blazhevich, 26 *Sequences*; A. LaFosse, *Method*, Book 2; A. Schroeder, 170 *Studies for 'Cello*; A. LaFosse, *School of Sight Reading and Style*.

Solos: S. Stojowski, *Fantaisie*; P. Gaubert, *Morceau Symphonique*; G. F. McKay, *Sonata*; G. Jacobs, *Concerto*.

TROMBONE 9

Comprehensive study of Bach, *Six Suites for Unaccompanied Violoncello*. Further emphasis on orchestral excerpts.

Typical material—Studies: Hansman (ed.), *R. Wagner Orchestral Studies*; Bertold (ed.), *R. Strauss, Orchestral Studies*; Flandrin, *Method*, Book 2.

Solos: J. Casterede, *Sonatine*; P. Hindemith, *Sonata*; C. Salzedo, *Pieza Concertante*; Jeno Takacs, *Sonata*.

Technic—Same as in Trombone 8 with increased speeds.

TROMBONE 10

A coverage of all types of styles and techniques used for solo, orchestral and ensemble playing. Memorization of standard orchestral excerpts and selected recital pieces.

Typical material—Studies: Continuation of Bach, *Six Suites for Unaccompanied Violoncello*; continuation of Flandrin, *Method*, Book 2; further study of LaFosse (ed.), *Orchestral Excerpts*; V. Blazhevich, *Concert Duets*; R. Borden, 12 *Serial Duets for Trumpet and Trombone*.

Solos: W. Hartley, *Sonata Concertante*; B. Childs, *Sonata*; K. G. Roy, *Sonata*; D. Milhaud, *Concertino d'Hiver*.

Technic—Same as in Trombone 9 with increased speeds.

BARITONE HORN — MUSIC 300 SECTION 01

BARITONE HORN 4

Further development of range, tone control, breathing, flexibility and articulation. Work on double and triple tonguing. Development of clef reading.

Typical material—Studies: continuation of A. Slama, 66 *Etudes*; J. Rochut, *Melodious Etudes*, Vol. 1; Gates, *Odd Meter Etudes*; H. Clarke, *Technical Studies*; Duham, 24 *Etudes*.

Solos: J. Galliard, *Sonatas for Bassoon*; A. Guilmant, *Morceau Symphonique*; B. Fitzgerald (ed.), *English Suite*.

Technic—All major and minor scales and straight arpeggios, one and two octaves, in simple and compound rhythm patterns, M.M. quarter note = 72.

BARITONE HORN 5

A review of all the fundamentals of baritone playing. Advanced flexibility exercises.

Typical material—Studies: Continuation of J. Rochut, *Melodious Etudes*, Vol. 1; O. Blume, 36 *Studies*; H. Voxman, *Selected Studies*; Sachse, 100 *Etudes*.

Solos: J. Barat, *Andante and Allegro*; A. Vivaldi, *Sonatas for 'Cello*; B. Fitzgerald, *Modern Suite*; A. Goedcke, *Concert Etude*.

Technic—All major and minor scales, the same as Baritone 4, plus in diatonic pattern, all at M.M. quarter note = 84. Major and minor arpeggios in straight and broken form at M.M. quarter note = 72.

BARITONE HORN 6

Work in improvisation. Further development of range and flexibility.
Typical material—Studies: C. Kapprasch, 60 *Studies*; J. Rochut, *Melodious Etudes*, Vol. 2; C. Colin, *Progressive Technique*; A. Laurent, *Etudes Pratiques*, Vol. 1 and 2. Solos: W. Hartley, *Sonatina*; Handel, *Concerto*; A. Corelli *Sonatas for 'Cello*; E. Bozza, *Badinage*.

Technic—Scales as in Baritone 5 with increased speeds, plus quintuplet grouping. Arpeggios as in Baritone 5, plus augmented, dominant seventh and diminished seventh.

BARITONE HORN 7

A study of the more advanced material with emphasis on recital literature.
Typical material—Studies: Continuation of J. Rochut, *Melodious Etudes*, Vol. 2; K. Kahila, *Advanced Studies*; H. Glantz, 48 *Studies*; R. Laurent, *Etudes Pratiques*, Book 3.

Solos: P. Vidal, 2nd *Concert Piece*; R. Sanders, *Sonata in E flat*; W. Latham, *Suite*.

Technic—Same as in Baritone 6 with increased speeds.

BARITONE HORN 8

Velocity studies and further development of solo style.
Typical material—Studies: T. Charlier, 36 *Etudes*; R. Sabarich, *Dix Etudes*; V. Blazhevich, 26 *Sequences*.

Solos: S. Stojowski, *Fantaisie*; P. Gaubert, *Morceau Symphonique*; G. F. McKay, *Sonata*; K. Riisager, *Concertino*.

Technic—Same as in Baritone 7 with increased speeds.

BARITONE HORN 9

Comprehensive study of Bach, *Six Suites for Violoncello*. Study of the standard orchestral repertoire.

Typical material—Studies: Berthold (ed.), R. Strauss, *Orchestral Studies*; Flandrin, *Method*, Part 2; M. Broiles, *Studies and Duets*, Vol. 2.

Solos: P. Hindemith, *Sonata for Trombone*; J. Casterede, *Sonatine*; C. Salzedo, *Pieza Concertante*; K. Kennan, *Sonata*.

Technic—Same as in Baritone 8 with increased speeds.

BARITONE HORN 10

A coverage of all types of styles and techniques used for solo, orchestral and ensemble playing. Memorization of standard orchestral excerpts and selected recital pieces.

Typical material—Studies: *Orchestral Excerpts*; continuation of Bach, *Six Suites for Unaccompanied Violoncello*; continuation of Flandrin, *Method*, Part 2; V. Blazhevich, *Concert Duets*; M. Bitsch, *20 Etudes*.

Solos: B. Childs, *Sonata for Unaccompanied Trombone*; W. Hartley, *Sonata Concertante*; K. G. Roy, *Sonata*; G. Enesco, *Legend*.

Technic—Same as in Baritone 9 with increased speeds.

TUBA — MUSIC 300 SECTION 15

TUBA 4

Further increase in range, technical facility and legato control.

Typical material—Studies: H. Voxman, *Advanced Method*, Vol. 1 and 2; R. Fink, *Legato Studies*.

Solos: A. Ostrander, *Concert Album for Tuba*.

Technic—All major and minor scales and straight arpeggios, one and two octaves, in simple and compound rhythm patterns, M.M. quarter note = 72.

TUBA 5

A review of all the fundamentals of tuba playing. Work on double and triple tonguing. Playing of trombone music an octave lower.

Typical material—Studies: J. Cimera, 79 *Studies*; J. Rochut, *Melodious Etudes*, Book 1; H. W. Tyrrell, *Advanced Studies*.

Solos: B. Beach, *Lamento*; L. Sowerby, *Chaconne*.

Technic—All major and minor scales, the same as Tuba 4, plus in diatonic pattern, all at M.M. quarter note = 84. Major and minor arpeggios in straight and broken form at M.M. quarter note = 72.

TUBA 6

Work on improvisation. Advanced work in flexibility.

Typical material—Studies: Continuation of J. Rochut, *Melodious Etudes*, Vol. 1;

A. Slama, 66 *Etudes in All Keys for Trombone*; C. Colin, *Progressive Technique*.

Solos: T. Beversdorf, *Sonata*; Bach-Bell, *Air and Bouree*; Beethoven-Bell, *Judas Maccabeus*.

Technic—Scales as in Tuba 5 with increased speeds, plus quintuplet grouping. Arpeggios as in Tuba 5, plus augmented, dominant seventh and diminished seventh.

TUBA 7

Playing from trumpet music for practice purposes. Emphasis on recital literature.

Typical material—Studies: E. Gates, *Odd Meter Etudes for All Treble Clef Instruments*; J. Rochut, *Melodious Etudes*, Vol. 2; B. Gregoriev, 78 *Etudes*.

Solos: A. Frackenpohl, *Concertino*; R. Spillman, *Concerto*.

Technic—Same as in Tuba 6 with increased speeds.

TUBA 8

Study of standard orchestral repertoire. Velocity studies and further development of solo type.

Typical material—Studies: V. Blazhevich, 70 *Etudes*; J. Rochut, *Melodious Etudes*, Vol. 3; R. Wagner and R. Strauss, *Orchestral Excerpts*.

Solos: V. Persichetti, *Serenade No. 12 for Solo Tuba*; W. Hartley, *Sonatina*; A. Lebedev, *Concert Allegro*.

Technic—Same as in Tuba 7 with increased speeds.

TUBA 9

Continuation of trumpet and trombone literature study.

Typical material—Studies: J. Rochut, *Melodious Etudes*, Vol. 3; R. Laurent, *Etudes Pratiques*, Book 3; W. Sear, *Orchestral Excerpts*.

Solos: W. Schmidt *Serenade*; A. Wilder, *Sonata*.

Technic—Same as Tuba 8 with increased speeds.

TUBA 10

A coverage of all types of style and technique used in solo, orchestral and ensemble playing. Memorization of standard orchestral excerpts and selected recital pieces.

Typical material—Studies: Continuation of trombone and trumpet literature study.

Solos: P. Hindemith, *Sonate*; R. Vaughn Williams, *Concerto*.

Technic—Same as Tuba 9 with increased speeds.

VOICE — MUSIC 300 SECTION 18

Applied Voice Major and Music Education Majors with Voice as major applied field should give evidence of ability to sing standard or classic art songs with adequate tone quality and intonation. In those cases where formal musical training is lacking the candidate should be assigned to a preparatory status by the Auditions Committee until such time as he is prepared to meet requirements set in Level 1. Some previous piano study is advisable.

Music Education majors with voice as their major applied field must have repertoire in two foreign languages to satisfy degree requirements. Applied voice majors must have repertoire in three languages to satisfy degree requirements.

LEVEL 4

Moderately difficult classic repertoire in English (Handel, Purcell, Haydn). Beginning songs from the *Anthology of Italian Song* (Schirmer). Romantic and contemporary repertoire in English as Edward Elgar, Edward MacDowell, Ernest Charles, Roger Quilter, Michael Head. Performance should demonstrate serious attention to phrasing in good taste and keeping with stylistic demands of the period; evidence of increasing ability to apply knowledge gained in other music courses, notably Theory, to gain insight into the music performed; beginnings of the mastery of vocal technique as evidenced by increased resonance and range, ability to sustain the breath, ability to execute attacks and releases, control dynamic changes within the phrase.

LEVEL 5

Continuation of classic Italian repertoire to include songs to develop flexibility and precise execution of embellishments. Italian Airs of Donaudy. English songs of greater musical complexity as Carpenter, Vaughn Williams, Duke, John Ireland. Performance should demonstrate an expansion of vocal technique and general musical literacy outlined in level 4.

LEVEL 6

More difficult Italian Baroque Arias as Handel, Scarlatti, Pergolesi containing florid passages. Other Italian airs as outlined in levels 4 and 5 with greater command of even legato, open and well placed vowels, clear diction. For Music Education voice majors this level to include also simple Lieder of Franz, Schubert, Schumann; or French folk songs Bergerettes (Weckerlin), or simpler songs of Hahn, Debussy, Goddard, etc. English songs as Barber's *Sure on This Shining Night*, Chandler's *The Children*, Nordoff's *There Shall Be More Joy*. Entering Applied voice majors should show a reasonable command of skills outlined in levels 4 and 5 and should have better than average vocal endowment (i.e. a good instrument). In addition, both Applied and Music Education majors should evidence in performance the beginnings of ability to project (i.e. audience contact or the ability to "put a song over").

LEVEL 7

Continuation of Classic Italian Literature. Easy oratorio and operatic arias. Lieder of the difficulty of Schubert's *Wohin*, Schumann's *Widmung*, Brahms' *Wie bist du meine Koenigin*, or French art songs as Debussy's *Romance*, Faure's *Les Berceaux*, Goddard's *Chanson de Florian*. Songs in English as Griffes' *By a Lonely Forest Pathway*; Hageman, *At the Well*.

LEVEL 8

German Lieder: Schumann's *Er der Herrlichste von Allen*; Schumann's *Und wusstens die Blumen die Kleinen*; Schubert's *Ungeduld*; Brahms' *Vergebliches Standchen*. French art songs as Debussy's *Chevaux de bois*, *Mandoline*; Duparc's *Chanson Triste*; Faure's *En priere*, *Lydia*; Koehlin's *Si tu le veux*; Hahn's *L'heure exquise*. Moderately difficult oratorio and operatic arias. Songs in English of Castelnuovo-Tedesco, Dello Joio, Hindemith, Britten, etc.

LEVEL 9

Continuation of 19th Century Lieder with the addition of Wolf and Strauss. Continuation of 19th Century French Art Songs. Contemporary Italian Songs as Cossella, Malipiero, Pizzetti, Respighi. Contemporary songs in English as Bernstein's *I Hate Music*; Ernst Bacon's *Quiet Songs*; Chandler's *Eight Epitaphs*; Vaughn Williams' *Songs of Travel*; Wagenaar *From a Very Little Sphinx*; Britten's *Winter Words*. Continuation of oratorio and operatic literature.

LEVEL 10

Arias from the cantatas of Bach or solo cantatas of Scarlatti, Handel, Pergolesi, etc. 19th and 20th Century Lieder of Mahler, Joseph Marx, Liszt, Wagner and later works of Wolf and Strauss. 19th and 20th Century French Songs of Debussy, Ravel, Poulenc, Milhaud, Satie, Honegger Messaien. Continuation of Contemporary Italian literature. Contemporary songs in English of Copland, Barber, Rorem, Diamond, Vaughn Williams.

GRADUATE LEVEL

Song cycles as Schumann's *Frauen Liebe und Leben*; Brahms' *Four Serious Songs*; Mahler's *Songs of a Wayfarer*; Poulenc's *Banalit s*; Ravel's *Sheherazade*; Debussy's *Trois Ballades*; Britten's *Charm of Lullabys*; Vaughn Williams' *On Wenlock Edge*; Hindemith's *Marienleben*; Barber's *Hermit Songs*. Complete operatic and oratorio roles. Songs of Berg, Schoenberg, Bartok, Stravinsky, DeFalla, Turina, Moussorgsky, Copland, Menotti, Cowell, Virgil Thompson.

PERCUSSION — MUSIC 300 SECTION 08

PERCUSSION 4

Snare Drum: Completion of the twenty-six rudiments. Continued refinement of technique and control. Basic technique on all accessories.

Studies: Wilcoxin, Stone, Gardner, Price.

Timpani: Beginning technique and tuning, grip, attack, roll, exercises for ear training.

Xylophone: Beginning technique and reading exercises, scales, arpeggios, and double stops. Studies: Goldenberg, *Modern School*.

PERCUSSION 5

Snare Drum: Work in advanced technique and control, contemporary and rudimental solos. Studies: Goldenberg, Wilcoxin, Stone.

Timpani: Tuning exercises and cross stickings; Goodman, *Modern Method for Timpani*.

Xylophone: Major and minor scales and chords two octaves; advanced exercises and etudes. Studies: Goldenberg and Gardner.

PERCUSSION 6

Snare Drum: Continuation of level 5. Addition of Latin drumming and coordination exercises. Studies: Morales, Pace, Wilcoxin.

Timpani: Three drum technique, quick tone changes. Goodman and Gardner methods.

Xylophone: Scales and chords in three octaves, double stops in thirds, sixths, and octaves. Transcriptions of violin and flute sonatas of Locillet, Handel, Bach.

PERCUSSION 7

Snare Drum: Advanced coordination studies. Work on recital literature and orchestral excerpts. Studies: Chapin, Gardner, Podenski.

Timpani: Four drum technique, advanced tuning changes, glissandi. Goodman and Gardner methods.

Xylophone: Continuation of level 6. Beginning three and four mallet studies. Rubank and Kraus methods.

PERCUSSION 8

Snare Drum: Advanced reading and coordination exercises. Studies: Sternberg, Cerolli, Chapin, Gardner.

Timpani: Solo literature and orchestral studies, continued tuning and pedal exercises. Goodman and Gardner methods.

Xylophone: Solo literature and orchestral excerpts, advanced etudes, three and four mallet exercises. Studies: Kraus, Peterson, Goldenberg.

PERCUSSION 9

Snare Drum: Added emphasis on solo and orchestral literature. Studies: Goldenberg, Gardner, Sternberg.

Timpani: Quick tuning changes, modern arrangements and orchestral studies.

Xylophone: Three and four mallet transcriptions for marimba and vibraphone, improvisation, modern arrangements.

PERCUSSION 10

Snare Drum: Review of all techniques and styles required for solo and ensemble playing. Studies: Dalghren, Cerolli, Gardner, Goldenberg.

Timpani: Concertos, sonatas and solos from Tausch, Jones, Carter, Bartok.

Xylophone: Solos, concertos, sonatas by Creston, Milhaud, Chopin, Bach, Handel. Continued three and four mallet exercises and arrangements of Ravel, Saint-Saens, Wagner, etc.

Division of Art

Candidates for the Degree of Master of Arts in Art must have an undergraduate major or minor in Art, a teaching field in Art, or the equivalent. Before being admitted to candidacy for the degree the student will take a comprehensive examination in the field and a test designed to demonstrate his ability to do graduate work, and any deficiency in preparation must be made up without graduate credit.

Divisional requirements for the degree are as follows:

1. Completion of a minimum of 30 semester hours of graduate work, including not more than 6 hours in thesis or problem.

2. Passage of a written comprehensive examination.
3. Completion of Art 290, Study of Original Works of Art (6 hours).
4. Passage of an oral examination on the thesis or problem.

Of the 30 hours, not more than 9 may be in studio courses.

With the consent of his committee, the student may elect a maximum of 6 hours in a related subject.

ART

211. **FIGURE DRAWING. I, II, S. 3 hr.** PR: Art 11 or 111, 12 or 112, and/or consent. Study of the construction of the figure. Drawing from the draped and partially draped model.
213. **PAINTING. I, S. 3 hr.** PR: Art 113, 117 and consent. First semester advanced watercolor.
214. **PAINTING. I, II, S. 3 hr.** PR: Art 213 and consent. Second semester advanced watercolor.
216. **PAINTING. II, S. 3 hr.** PR: Art 114, 118, and consent. First semester advanced oil painting.
217. **PAINTING. I, II, S. 3 hr.** PR: Art 216 and consent. Second semester advanced oil painting.
220. **ART AND THE SCHOOLS. I, II, S. 2 hr.** PR: 4 hr. of Art, including a minimum of 2 hr. studio. The function of art in the curriculum at various grade levels and a study of standards of achievement.
221. **ADMINISTRATION AND SUPERVISION OF ART. I, II, S. 2 hr.** PR: Art 220. Mainly for administrators and school principals who wish to become informed about all programs and the philosophies underlying them.
225. **SECONDARY SCHOOL ART. I or II, S. 3 hr.** PR: Art 11 or 111, 12 or 112, 121, 122, 113, 114, and consent. Information and working skills desirable for the teaching of art on the secondary school level.
241. **MEDIEVAL ARCHITECTURE. I, II, S. 3 hr.** PR: Art 105, 106. A study of architecture from the time of Constantine to the Renaissance.
250. **RENAISSANCE PAINTING. I, II, S. 3 hr.** PR: Art 105, 106. A study of painting in Italy from Simebue to Tiepolo; the Renaissance in Western Europe; a brief consideration of baroque and rococo painting as outgrowth of the Renaissance. Offered 1966-67 and alternate years.
260. **MODERN PAINTING. II, S. 3 hr.** PR: Art 105, 106. Development in painting from the French Revolution to the present day.
271. **AMERICAN ARCHITECTURE. I, II, S. 3 hr.** PR: Art 105, 106. Developments in architecture in North America from Pre-Columbian times to the present day. Emphasis will be placed on the architecture of the United States.
275. **LATIN AMERICAN ART. I, II, 3 hr.** PR: Consent of the instructor. Art from Pre-Columbian times to the present. Outstanding examples of the various periods will be considered.
290. **STUDY OF ORIGINAL WORKS OF ART. S. 6 hr.** PR: Art 105, 106, and consent of the Department. Directed study of the museums and libraries of some urban center such as Washington or New York; a study of the architectural developments of the locality.
- 350, 351. **SPECIAL TOPICS. I, II, S. 1-3 hr. per sem.** PR: Consent of the Department. Individual study to be determined by the student's requirements.
397. **RESEARCH. I, II, S. 1-15 hr. (thesis, 6 hr.).** PR: Approval of Student's Committee.

Division of Drama

THE DEGREE OF MASTER OF ARTS

Persons who possess a Bachelor's degree from an accredited college or university may be admitted to the program. Any deficiencies in undergraduate preparation in upper-division courses in Drama appropriate to the anticipated area of specialization will be made up either without credit or (in instances of 200 or above numbered courses) added to the credit required for the degree.

1. Successful completion of the minimum number of required graduate hours as set forth in Program "A" or Program "B" below.
2. Completion, within the framework of the Graduate School and Division of Drama standards, of one of the two following programs of study:
 - A. Concentration program which meets the following requirements:
 - (1) Successful completion of at least a minimum of 30 semester hours of graduate credit. No more than 9 of the 30 credit hours will be in research and thesis.
 - (2) Successful passage of comprehensive written examination in the fields of study. Such examinations are administered toward the end of the student's course work and then only if and when the student has a "B" grade-point average of 75 per cent of his credit hours are of "B" grade or higher.
 - (3) Submission for approval by the student's graduate committee of a thesis demonstrating original research and scholarly reporting.
 - (4) Successful completion of an oral examination on the thesis.
 - B. General program which meets the following requirements:
 - (1) Similar to above program (A) with a total of 36 hours required. The six additional hours to be substituted for the thesis requirement and to be taken in drama or cognant fields upon the approval of the faculty adviser.
 - (2) Successful passage of comprehensive examinations, both written and oral, in all areas of Drama. Either a 3.0 (B) grade-point average or 75 per cent of "B" grades for the hours carried is prerequisite to taking written comprehensive examinations.
3. The student pursuing Program A or Program B will emphasize either a directing or a design specialty, oriented toward a professional or teaching career in drama.

DRAMA

202. SCENE DESIGN. II. 3 hr. PR: Drama 100 or consent. Lecture and laboratory in theories of scene design for stage and television, including actual construction of designs. Open to juniors, seniors, and graduate students.
203. ADVANCED PRODUCTION DESIGN. I, II. 3 hr. PR: Consent. Student work in a specific area of technical theatre for advanced credit. May repeat up to a maximum of 6 hr.
250. ADVANCED PROBLEMS IN INTERPRETATION. II. 3 hr. PR: Drama 50 and consent. Designed to deal with individual problems of advanced students in interpretation.
251. PROFESSIONAL READING. I, II. 3 hr. PR: Consent. Intensive training in interpretation. Designed to meet needs of individual. Full length public recital prepared and presented. Limited enrollment.
252. ART OF STORYTELLING. S. 3 hr. PR: Consent. Principles involved in effective presentation of stories, with practical experience in classroom and before audiences. Stories of all types for adults and children studied.
260. THEATRE PERFORMANCE AND REHEARSAL LABORATORY. I, II. 1 to 3 hr. PR: Drama 161 or consent. Participation in assigned theatre projects. Appreciation of creativity and performance techniques in theatre. Majors only. Maximum credit, 6 hr.

- 275. ADVANCED ACTING. II. 3 hr. PR: Drama 75 and consent. Characterization, script analysis, style, theories, and techniques. Designed to meet needs of individual student.
- 280. ADVANCED PLAY DIRECTING. II. 3 hr. PR: Drama 180, or consent. Emphasis on work of directing as an integrating artist. Display of high level of proficiency in direction of a one-act play required of all students enrolled.
- 281. THEATRICAL DIALECTS. I. 3 hr. PR: Consent. Study and mastery of 15 common dialects used in theater and radio.
- 282. CREATIVE DRAMATICS. I. 3 hr. PR: Drama 75 or consent. The study and practice of creative dramatic activity as a method of learning and self development for children.
- 283. PLAYWRITING. II. 3 hr. PR: Consent. Development of creative ability in dramatic composition. Study of techniques and problems of playwriting. Of cultural value, but primarily a writing course.
- 285. ADVANCED HISTORY OF THEATER. II. 3 hr. Historical survey of theater from primitive time to present. Includes both oriental and occidental theaters.
- 286. DRAMA CRITICISM AND AESTHETICS. I. 3 hr. A survey of chief critical and aesthetic theories of drama-ancient, modern contemporary.
- 300. APPLIED CREATIVE PERFORMANCE. 3 hr. Creative projects and/or performance. Must have faculty approval as part of student's graduate program.
- 331. RESEARCH METHODS AND SURVEY. 3 hr. PR: Consent. Research methods and techniques and general survey of the field of drama.
- 344. SURVEY OF EDUCATIONAL METHODS AND PRACTICES. 3 hr. Survey and critical study of the total drama education program.
- 360. SPECIALIZED SEMINARS. 3-9 hr. PR: Consent. Selected fields of study in drama. (May be repeated for a maximum of 9 credit hours).
- 397. RESEARCH. I, II. 1-15 hr. Student may enroll in research or thesis with consent of adviser.

ENGINEERING

REQUIREMENTS FOR ADMISSION

A student desiring to take courses for graduate credit in the College of Engineering must first comply with the appropriate regulations of the Graduate School.

After having been admitted to the Graduate School, a student who intends to become a candidate for a degree must apply for admission to the major department of his choice. Acceptance by the major department will depend upon review of the student's academic background and the available facilities in the department.

An applicant with a baccalaureate degree, or its equivalent, from a department accredited by the Engineers' Council for Professional Development will be admitted on the same basis as engineering graduates of West Virginia University. Lacking these qualifications, an applicant must first fulfill the requirements of the department in which he is seeking an advanced degree.

Admission to candidacy for a graduate degree is required prior to obtaining that degree. A graduate student may apply for admission to candidacy by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0, based on all graduate courses, taken in residence, for which he has received a grade at the time of application.

ACADEMIC STANDARDS

No credits which are reported with a grade lower than C are acceptable toward an advanced degree.

To qualify for an advanced degree, the graduate student must have a grade-point average of at least 3.0 based on all graduate courses for which he has received a grade from the University.

CURRICULA

Each candidate for a degree must select his major subject in that department in which his degree is taken:

Ph.D. Degree—See departmental descriptions.

M.S. Degree—Each department has a designated M.S. degree and in addition the College has an undesignated degree, Master of Science in Engineering. For all M.S. degrees each candidate will, with the approval of his graduate committee, follow a planned program which must conform to one of the following outlines:

1. A minimum of 30 semester credit hours, not more than 6 of which are in research leading to an acceptable thesis.
2. A minimum of 33 semester credit hours, not more than 3 of which are in research leading to an acceptable problem report.
3. A minimum of 36 semester credit hours, with no thesis or problem report required.

At least one-half of the courses taken, exclusive of research, must be in the College of Engineering with as many as possible at the 300 level.

A graduate student in the College of Engineering must comply with the regulations of his major department.

MASTER OF SCIENCE IN ENGINEERING

This interdepartmental degree program is designed for students who desire to pursue work in areas other than that of their baccalaureate degree in engineering or science. Graduate students who wish to become candidates for this degree should register with the department in which the major portion of the work is to be done.

Admission and Academic Standards. Students must comply with the rules and regulations as outlined under Requirements for Admission and Academic Standards for graduate work in the College of Engineering.

Adviser and Examining Committee. Each student will be assigned an adviser and an advisory and examining committee will be appointed by the department in which the major portion of the work is to be done.

Final Examination. On completion of the course requirements a candidate for the degree of Master of Science in Engineering shall be required to pass a final examination which may be written, or oral, or both, covering both course material and the thesis or problem report, depending upon the option selected.

THE DEGREE OF DOCTOR OF PHILOSOPHY

Admission. Admission to the Graduate School of West Virginia University is required of all applicants for admission to a program of study and research leading to the Ph.D. Applicants for admission are expected to have successfully completed a Bachelor of Science or Master of Science degree program in some phase of engineering equivalent to the program leading to this degree in effect at West Virginia University. Admission to the Graduate School does not necessarily assure entrance into the College of Engineering Ph.D. program. Formal admission to the Ph.D. program is granted by the Graduate Programs Executive Committee after review of a student's petition which includes a record of his academic performance and a proposed program of study.

Requirements for Candidacy. After admission to the program and after a period of residence, the applicant will be admitted to a comprehensive preliminary or qualifying examination (either oral or written or both) in which he must demonstrate: (a) a grasp of the important phases and problems of the field of study in which he proposes to major and an appreciation of their relation to other fields of human knowledge and accomplishments; (b) the ability to employ rationally the instruments of research developed in his major field; and (c) the ability to read two approved languages in a satisfactory manner.

When an applicant has successfully passed his comprehensive examination he will be formally admitted to candidacy for the Doctor's degree. Admission to candidacy must precede the final examination for the Doctor's degree. Graduate courses pursued in fulfillment of the requirements for the Master's degree, if of suitable character and quality, may be credited toward the doctorate.

Curriculum. The degree of Doctor of Philosophy is not awarded for the mere accumulation of course credits nor for the completion of a definite residence requirement. The exact amount and nature of the course work to be undertaken by a candidate will be established for each individual candidate with the object of insuring a rational and coherent progression of academic development beyond the Bachelor of Science degree.

Residence. The requirements for the degree of Doctor of Philosophy contemplate approximately three years of full-time graduate work beyond the Bachelor's degree. A minimum of 36 weeks in residence in full-time graduate study or its equivalent at West Virginia University is required, and must include a minimum of two semesters at the University.

Dissertation. The candidate must submit a dissertation on a topic within the area of his major interest. The dissertation must represent the results of independent research and must constitute a definite contribution to knowledge. It is anticipated that the work leading to the completion of the dissertation would require 24 hours in research and/or dissertation credits or satisfactory evidence of equivalent time devoted to research and preparation of the dissertation.

Final Examination. Upon completion and approval of the dissertation and fulfillment of all other requirements, the candidate shall pass a final examination conducted by a committee of at least five members recommended by the major department and appointed by the Dean of the Graduate School. The examination shall be primarily a defense of the dissertation although other questions necessary to establish the validity of the dissertation may be in order.

AEROSPACE ENGINEERING

MASTER OF SCIENCE IN AEROSPACE ENGINEERING

Students must comply with rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

Thesis. Normally a thesis is required of all candidates for the degree of Master of Science in Aerospace Engineering. Approval by the Advisory and Examining Committee is necessary before the thesis will be accepted. The thesis must be presented in a form that conforms to general requirements of the Graduate School, and in addition should conform to additional thesis requirements of the Department of Aerospace Engineering.

Whether or not a thesis is required shall be determined by the department and shall be recorded in the student's file as a part of his planned program.

Final Examination. Each candidate for the Master's degree shall pass a final examination administered by his Advisory and Examining Committee.

Courses. The following grouping of courses is given as a guide for selecting a graduate program leading to the degree of Master of Science in Aerospace Engineering.

Group I. Required of all candidates. Six semester credit hours of advanced mathematics beyond a first course in differential equations.

Group II. Major. Minimum of 9 semester hours of Aerospace Engineering courses, other than A.E. 397, in the 300 series.

In order to meet the minimum requirements for the degree of Master of Science in Aerospace Engineering, additional courses may be taken from the following, subject to the approval of the student's Advisory and Examining Committee:

1. Courses from Groups I and II.
2. Aerospace Engineering courses in the 200 series which are not required for the degree of Bachelor of Science in Aerospace Engineering of West Virginia University.
3. Physics and Chemistry courses in the 200 or 300 series.
4. Courses in other departments of the College of Engineering in the 200 or 300 series.

THE DEGREE OF DOCTOR OF PHILOSOPHY

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

Candidates for the Doctor of Philosophy degree, regardless of their specific major, may be required to attain a proficiency in each of the following areas: (1) fluid mechanics, (2) thermodynamics, and (3) applied mathematics.

The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the field of Aerospace Engineering. It must have good literary form and style, and must give a thorough survey of prior literature in the subject. The candidate is required to take a final oral examination upon completion of the dissertation in defense of his research.

AEROSPACE ENGINEERING

201. FLUID DYNAMICS I. 4 hr. PR: Math. 253; or conc: M.E. 120, A.E. 116. Properties of the fluid medium, dimensional analysis, hydrostatics, kinematics and dynamics of a fluid field, perfect fluid flow about a body, complex potential function, conformal transformation, thin airfoil theory, finite wing theory. 4 hr. lec.
203. APPLIED AERODYNAMICS. 3 hr. PR: A.E. 209. Chordwise and spanwise airload distribution for plain wings, wings with aerodynamics and geometric twist, wings with deflected flaps, and wings with ailerons deflected. Section induced drag characteristics. 3 hr. lec.
205. EXPERIMENTAL FLUID DYNAMICS. 2 hr. PR: A.E. 223. Subsonic and supersonic wind tunnel testing methods and practice. Experiments include the following measurements: pressure distribution on bodies, boundary layer determination, turbulence measurements, force tests, and stability and performance determinations. Corrections for scale and jet boundary effects. Data collection. Data reduction by digital computer. Test design, data analysis, and engineering report preparation. 1 hr. lec., 3 hr. lab.
207. FLIGHT VEHICLE DESIGN. 3 hr. PR: A.E. 209. Preliminary design of flight vehicles. Vehicles are designed with regard for performance and stability requirements, considering aerodynamics, weight and balance, structural arrangement, configuration, guidance, and propulsive effects. Layout drawings and calculations are combined in a preliminary design report. 1 hr. lec., 6 hr. lab.
208. FLIGHT TESTING. 2 hr. PR: A.E. 209. Flight test theory and practice. Stability and performance determination based on flight tests of a Cessna Super Sky-wagon and a Cessna Model 150. Flight test data reduction practice. 1 hr. lec., 3 hr. lab.

209. FLIGHT MECHANICS. 3 hr. PR: A.E. 201. Performance estimation with emphasis on fixed wing aircraft. Fundamental concepts of stability and control of aircraft. 3 hr. lec.

210. FLIGHT VEHICLE STRUCTURES I. 3 hr. PR: T.A.M. 103. Strength of thin walled structures in bending, shear, and torsion. Strain energy and application of Castigliano's theorem to bending of rings and curved bars, and to analysis of frames. Principle of virtual work and its application to beam and truss deflections and to statically indeterminate structures. 3 hr. lec.

211. FLIGHT VEHICLE STRUCTURES. II. 3 hr. Tension fields and the design of Wagner beam. Buckling of compression structures: bars, sandwich columns, torsional instability of columns, wrinkling in sandwich construction, plates, shells and stiffened panels. Design for minimum weight. Introduction to thermal stresses. Failure by fatigue and fracture. 3 hr. lec.

212. DESIGN OF FLIGHT STRUCTURES I. 3 hr. PR: A.E. 207 and A.E. 211. Structural design of flight vehicle members. Layout and detail design of specified components are required. 1 hr. lec., 6 hr. lab.

213. EXPERIMENTAL FLIGHT VEHICLE STRUCTURES. 1 hr. PR: A.E. 211. Strength tests of flight vehicle materials, center of gravity determination, static test of components, bending and torsion of shell structures, compression tests of thin-walled structures. 3 hr. lab.

217. DESIGN OF FLIGHT STRUCTURES II. 3 hr. PR: T.A.M. 103. Analysis and detail design of simple fittings, beams, welded structures, forgings, castings. Methods of production and fabrication. 1 hr. lec., 6 hr. lab.

218. AEROLASTICITY. 3 hr. PR: A.E. 210. The study of vibrating systems of single degree and multiple degrees of freedom, flutter theory and modes of vibration, torsional divergence and control reversal. 3 hr. lec.

219. INTRODUCTION TO RESEARCH. 1-3 hr. PR: Senior standing and consent. An introduction to the methods of organizing theoretical and experimental research. Formulation of problems, project planning, and research proposal preparation.

220. RESEARCH PROBLEMS. 2-6 hr. PR: A.E. 219. Performance of the research project as proposed in A.E. 219. Project results are given in written technical reports, with conclusions and recommendations.

223. FLUID DYNAMICS II. 3 hr. PR: A.E. 201, M.E. 120. Introduction to compressible, nonviscous fluids, isentropic flow, Prandtl-Meyer expansion, shock waves, airfoils in compressible flow, boundary layer, exact and integral solutions, introduction to turbulence. 3 hr. lec.

224. FLUID VEHICLE PROPULSION. 3 hr. PR: A.E. 223. Application of thermodynamics and gas dynamics to combustion. Turbine cycles with emphasis on turboprop and turbojet propulsion. Ramjets. Rocket propulsion by chemical, nuclear and electrical systems. Propulsion of staged vehicles. 3 hr. lec.

225. GUIDED MISSILE SYSTEMS. 3 hr. PR: A.E. 223, and/or conc: A.E. 224. Design philosophy according to mission requirements. Preliminary configuration and design concepts. Aerodynamics effects on missiles during launch and flight. Ballistic missile trajectories. Stability determination by analog simulation. Performance determination by digital and analog simulation. Control guidance and propulsion systems. Operational and reliability considerations. 3 hr. lec.

226. FLUID DYNAMICS IV. 3 hr. PR: A.E. 223. Shock tube theory and applications. Introduction to kinetic theory, the calculation of viscosity and thermal conductivity. Fundamentals of hypersonic flow and the determination of minimum drag bodies. 3 hr. lec.

227. ADVANCED TOPICS IN PROPULSION. 3 hr. PR: A.E. 224 or consent. Theoretical analysis of combustion and detonation and its application to jet and rocket engines. Application of nuclear energy to aircraft and rocket propulsion. Electrical propulsion systems. Solar sails and other exotic systems. 3 hr. lec.

258. SPACE MECHANICS. 3 hr. PR: Math. 253, T.A.M. 104. An introduction to flight in and beyond the earth's atmosphere by space vehicles. The laws of Kepler and Orbital theory. Energy requirements for satellite and interplanetary travel. Exit from and entry into an atmosphere. 3 hr. rec.

280. AEROSPACE PROBLEMS. 1-3 hr. Upper division and graduate.

299. THESIS. 2-6 hr. PR: Senior standing and consent.

351. DYNAMICS OF VISCOUS FLUIDS. 3 hr. PR: Consent. Exact solutions of the Navier-Stokes equations. Laminar incompressible and compressible boundary layer theory, similarity solutions and integral methods. 3 hr. lec.

353. PERFECT FLUID THEORY. 3 hr. PR: Consent. Use of Lagrangian and Eulerian variables, kinematic properties of rotational flows, Biot-Savart law and applications, conformal mapping including Schwarz-Christoffel and Joukowski transformations. Thin airfoil theory, three dimensional wing theories. 3 hr. lec.

354. ADVANCED FLIGHT MECHANICS. 3 hr. PR: A.E. 209, 223. Dynamic stability. Obtaining flight characteristics of the vehicle from dynamic flight test techniques, such as frequency response, and transient response methods. The problems of automatic control. 3 hr. lec.

355. GAS DYNAMICS. 3 hr. PR: A.E. 223. Nonsteady gas dynamics and shock tube theory. Applications of shock tubes in aerospace research. Compressible flow theory in the subsonic, transonic, and supersonic regimes. 3 hr. lec.

356. FLUID FLOW MEASUREMENTS. 3 hr. PR: A.E. 205, 223. The principles and measurements of: static and dynamic pressures and temperatures, velocity and Mach number, forces. Optical techniques and photography. Design of experiments. Review of selected papers from the literature. 2 hr. lec., 3 hr. lab.

357. SPECIAL PROBLEMS. 2-4 hr. PR: Consent of department chairman. A course for graduate students in the non-research program. The student will select a specialized field and follow a course of study in that field under the supervision of a counselor.

358. SPACE MECHANICS. 3 hr. PR: Math. 245; A.E. 223, 224. Variational formulation of mechanics. Theory of orbits and trajectories with applications to astronomical problems. Introduction to the space environment of the solar system. 3 hr. lec.

359. DYNAMICS OF REAL GASES. 3 hr. PR: A.E. 351 or consent. Fundamentals of multi-component gas flow from a molecular viewpoint; thermodynamic properties of equilibrium mixtures from statistical mechanics; chemical kinetics; derivation of the gas dynamic conservation equations from Maxwell's transport equation; effects of the chemical model on high-temperature, high-speed flow properties.

360. FUNDAMENTALS OF TURBULENT FLOW. 3 hr. PR: A.E. 351 or consent. Survey of the basic experimental data. Application of the semi-empirical theories to pipe, jet and boundary layer flow. Turbulent heat and mass transfer. Statistical theory of turbulence and recent applications. Hydrodynamic instability and its relation to transition. 3 hr. lec.

362. FOUNDATIONS OF MAGNETOHYDRODYNAMICS I. 3 hr. PR: Consent. Effects of ionization in gas flows; equations of state, charge, mass, momentum and energy conservation; effects of self-generated and external electric and magnetic fields on electrically conducting fluids and transport coefficients. 3 hr. lec.

363. APPLIED MAGNETOHYDRODYNAMICS II. 3 hr. PR: A.E. 362 or consent. Incompressible and compressible viscous MHD channel flow; plane waves in fluids, discontinuities and MHD shock waves; applications of MHD to electric power generation, etc. 3 hr. lec.

372. ADVANCED AEROELASTICITY. 3 hr. PR: A.E. 218. Deformation of structures under static and dynamic loads, flutter of straight and swept wings, disturbed motion of an elastic model, dynamic response in gusts and landings, the aeroelastic model theory. 3 hr. lec.

373. DYNAMIC LOADS. 3 hr. PR: A.E. 203, 218. Dynamics of a particle, lift distribution during accelerated maneuvers, beam bending and torsion with unsteady loads, empennage loads during dynamic flight conditions, landing impact loads. 3 hr. lec.

374. MATERIALS AND THEORIES OF FAILURE. 3 hr. PR: A.E. 211. Failures in simple stress states, combined stress states; method of fatigue failure, minimum weight structures, evaluation of material to resist design load condition. 3 hr. lec.

375. ADVANCED FLIGHT VEHICLE STRUCTURES. 3 hr. PR: A.E. 211. Incomplete tension fields, critical loads, torsional column failure, instability of flat sheets, cylindrical structure, special methods of analysis. 3 hr. lec.

397. RESEARCH. 1-15 hr. Advanced research or special investigations on some topic relating to aerospace engineering.

AGRICULTURAL ENGINEERING AND FOREST ENGINEERING

MASTER OF SCIENCE IN AGRICULTURAL ENGINEERING

A. D. LONGHOUSE, *Program Director*

Before being admitted to graduate work in the Department of Agricultural Engineering, the prospective student must be admitted to the Graduate School. Candidates for the M.S. in Agricultural Engineering degree must first satisfy the requirements of the B.S. in Agricultural Engineering degree or its equivalent from a recognized agricultural engineering department. In general, candidates must meet the requirements of the B.S. in Agricultural Engineering degree, but candidates who have an engineering degree other than the B.S. in Agricultural Engineering degree may choose the M.S. in Engineering degree and need not satisfy or remove the requirements for the B.S. in Agricultural Engineering degree.

Thesis. A thesis is required of all candidates for the M.S. in Agricultural Engineering degree or M.S. in Engineering degree. In most cases it will be necessary to take 6 hours of research work, Agricultural Engineering 397. A thesis, however, is not automatically approved after the required number of semester hours of research work has been completed. The candidate may find that completion of the thesis for approval will delay his originally anticipated date of graduation. The major subject, including thesis, must be taken in the Department of Agricultural Engineering. Candidates may specialize in power and field machinery, soil and water conservation, farm structures, or electric power and processing. On satisfactory completion of his thesis and course work, the candidate will be given an examination by his special committee.

Thesis Supervisor. Each student will be assigned a thesis supervisor who will serve as chairman of his graduate committee.

AGRICULTURAL ENGINEERING

200. SEMINAR. I. 1 hr. PR: Senior or graduate standing.

201. AGRICULTURAL STRUCTURES. II. 3 hr. PR: T.A.M. 102. Structural design and functional requirements of agricultural buildings. 2 hr. rec., 3 hr. lab.

210. ELECTRIC POWER. II. 3 hr. PR: E.E. 105. Economic application of electric light, heat, and power. 2 hr. rec., 3 hr. lab.

220. AGRICULTURAL PROCESS ENGINEERING. II. 3 hr. PR: C.E. 115, M.E. 121. Application of the fundamentals of engineering to agricultural engineering processes. 2 hr. rec., 3 hr. lab.

230. FARM POWER. I. 3 hr. PR: M.E. 121. Fundamental theories underlying design and operation of internal combustion engines used in agriculture 2 hr. rec., 3 hr. lab.

240. HYDROLOGY. I. 3 hr. PR: C.E. 115. Study of a hydrologic cycle with emphasis on precipitation and runoff as related to design of hydraulic structures, soil and water conservation, and flood control. 3 hr. rec.

241. PHYSICAL CLIMATOLOGY. II. 3 hr. PR: Consent. Physical principles underlying the variations and changes in climate, climatic controls, elements of micro-climatology, engineering applications and uses of climatic data. 3 hr. rec.

250. SOIL AND WATER CONSERVATION. I. 3 hr. PR: C.E. 115. Engineering principles and practices in conservation, utilization, and management of soil and water resources. 2 hr. rec., 3 hr. lab.

290. ELEMENTS OF MACHINERY DESIGN. II. 3 hr. PR: M.E. 201. Design requirements for construction, principles of operation and adequate adjustment of agricultural machines and principles of testing agricultural equipment. 2 hr. rec., 3 hr. lab.

320. 321. SPECIAL TOPICS. I, II, S. 1-6 hr. (For the Master's degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).

340. PROBLEMS IN HYDROLOGY. I. 3 hr. PR: Ag. Eng. 240. Consideration of special problems in hydrograph analysis, hydrologic performance of small watersheds, erosion and sedimentation, hydro-meteorological studies, flood runoff and peak discharge, droughts, river forecasting, frequency analysis of hydrologic data. Special report. 3 hr. rec.

397. RESEARCH. I, II, S. 1-15 hr.

FOREST ENGINEERING

MASTER OF SCIENCE IN ENGINEERING

A. D. LONGHOUSE, *Program Director*

Admission. The graduate program in Forest Engineering leads to the degree of Master of Science in Engineering. It is open to graduates of wood science, forest science, or accredited engineering curricula. Students with Bachelor of Science degrees in Forestry, Agriculture, Mathematics, or Physics are eligible, providing certain undergraduate requirements are satisfied.

Students must comply with the rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

A student is admitted to candidacy for the Master of Science in Engineering degree only by formal written application after he has completed at least 12 credit hours of graduate work at West Virginia University with a grade-point average of at least 3.0.

Candidates with no training in Forestry will be required to take courses in the Division of Forestry.

Candidates may select one of three areas for specialization:

1. *Hydrology.* Course requirements include: Ag. Eng. 240, G.E. 221, 252, Geol. 261, 263, Math. 257, 258, 211 and 212 or I.E. 244 and 214. Electives will be selected to take into account the student's background and interests.

2. *Power and Machinery.* Course requirements include: Math. 257, 258, 211 and 212, or I.E. 244 and 214, Forest Eng. 391, 392. Electives will be selected to take into account the student's background and interests.

3. *Industrial.* Course requirements include: Math. 257, 258, 211 and 212 or I.E. 244 and 214. Electives will be selected to take into account the student's background and interests.

Thesis Supervisor. Each student will be assigned a thesis supervisor who will serve as chairman of his thesis committee.

Thesis. A thesis is normally required of all candidates for the Master of Science in Engineering Degree. In most cases it will be necessary to take 6 hours of research, Forest Eng. 397. A thesis, however, is not automatically approved after the required number of semester hours of research work have been completed. The candidate may find that completion of the thesis for approval will delay his originally anticipated date of graduation. The major subject, including thesis, must be taken in Forest Engineering. Upon satisfactory completion of his thesis and course work, the candidate will be given an examination by his special committee.

FOREST ENGINEERING

300. SEMINAR. I or II. 1 hr. Current discussion of research in forest engineering and special report.

320. ADVANCED INDEPENDENT STUDY. I, II, S. 1-6 hr.

391. LOGGING SYSTEMS ENGINEERING. I. 3 hr. PR: Math. 140 or consent. Theory and design of modern forest harvesting systems such as balloon logging, cableways, pipelines and conveyors. Design features of specialized forest harvesting machines and devices. Systems engineering approach to equipment utilization. 3 rec.

392. HYDRAULIC POWER. II. 3 hr. PR: Math. 140 or consent. Includes characteristics of hydraulic control components, hydraulic fluid characteristics, materials in hydraulic circuits, components and elements for circuit design, the feedback control approach, derivation of component transfer functions, measuring control dynamic characteristics, computer simulation techniques, hydraulic control circuits and hydraulic design practice. 3 rec.

397. RESEARCH. I, II, S. 1-15 hr. Advanced research or special investigations on some topic related to forest engineering.

CHEMICAL ENGINEERING

MASTER OF SCIENCE IN CHEMICAL ENGINEERING

MASTER OF SCIENCE IN ENGINEERING

H. P. SIMONS, *Program Director*

Students must comply with rules and regulations as outlined in General Requirements for graduate work in the College of Engineering. In addition, admission to any program presupposes a mathematics background at least through differential equations.

A student is admitted to candidacy for the Master's degree only on formal application after he has completed at least 12 hours of graduate work in West Virginia University with a grade-point average of at least 3.0.

MASTER OF SCIENCE IN CHEMICAL ENGINEERING

The M.S.Ch.E. program is professionally oriented, specifically designed for those wishing to pursue the active practice of engineering, and consists of a 36-hour non-thesis sequence. Admission is restricted to those holding a baccalaureate degree in chemical engineering from an accredited institution.

Courses. Required courses include Advanced Mathematics, Ch.E. 344-345, Ch.E. 302-304-306-307, Ch.E. 383, and at least 4 hours of Ch.E. 310. Students must elect either the Ch.E. 323-324 (process development) sequence or the Ch.E. 372-373 (design) sequence.

Industrial Practice. Candidates for the M.S.Ch.E. degree must show evidence of industrial employment during two summers, usually that immediately preceding admission to the program and that following the first year. Note: This requirement may be waived in certain cases where such employment is precluded.

Final Examination. The final examination will consist of the solution of a comprehensive problem of professional character, administered by an examining board appointed by the program director, followed by an oral defense of the solution before the examining board, which will evaluate the solution according to professional standards.

MASTER OF SCIENCE IN ENGINEERING

The M.S.E. program is strongly science-oriented and is designed for those who wish to follow a career in research or development or certain areas of teaching. Admission may be granted to those holding baccalaureate degrees in chemical engineering, in other engineering disciplines, or in certain pure sciences. If the orientation examination so indicates, certain prerequisite courses may be required.

Courses. Required courses include Advanced Mathematics, Ch.E. 344-345, and Ch.E. 304-306. Six-hour blocks of advanced physical, organic, or inorganic chemistry, physics, mathematics, or nuclear engineering will be required.

Thesis Supervision. Each student will be assigned to a thesis supervisor who will serve as chairman of his advisory and examination committee.

Thesis. Normally a thesis will be required of all candidates for the M.S.E. degree and in practically all cases it will be necessary to complete 6 semester hours of research work, Ch.E. 397; however, a thesis is not automatically approved after 6 hours have

been completed. The thesis must conform to the general requirements of the Graduate School.

Facilities. The Chemical Engineering laboratories are well equipped for fundamental study and research in the various phases of heat, momentum and mass transfer, and in rate processes. The control laboratory immediately adjacent is provided with the latest measurement and control instruments and a forty-five amplifier analog computer for process dynamics and systems engineering.

MATERIALS SCIENCE ENGINEERING MASTER OF SCIENCE IN ENGINEERING

H. V. FAIRBANKS AND P. R. JONES, *Program Co-directors*

The materials science program and its admission requirements are quite similar to the M.S.E. program described above. However, applicants must present entrance credits including an acceptable background of mathematics and physical science in addition to the general requirements.

Courses. Required courses include Advanced Mathematics, Mat.E. 356-357, Mat.E. 358-359, Mat.E. 263-264, and 6 hours of Mat.E. 397. A minimum of 36 hours are required for this degree. By special permission, certain other courses may be substituted for Mat.E. 263 or Mat.E. 264.

Thesis Supervision. Each student will be assigned to a thesis supervisor who will serve as chairman of his advisory and examination committee.

Thesis. Normally a thesis will be required of all candidates for the M.S.E. degree and in practically all cases it will be necessary to complete 6 semester hours of research work, Mat.E. 397; however, a thesis is not automatically approved after 6 hours have been completed. The thesis must conform to the general requirements of the Graduate School.

Facilities. The specialized facilities for Materials Science Engineering include well equipped laboratories for the complete preparation, examination, and testing of materials including ceramics, metals, alloys and synthetics, and for research in these areas. In addition, the laboratory facilities of other departments may be utilized.

NUCLEAR ENGINEERING

MASTER OF SCIENCE IN NUCLEAR ENGINEERING

J. A. KENT, *Program Director*

Students must comply with rules and regulations as outlined in the General Requirements for graduate work in the College of Engineering. Students with a B.S. in Engineering from an accredited engineering department will be admitted to the program provided they have a course in differential equations. Students with a Bachelor of Science in one of the physical sciences or in mathematics may be required to take certain undergraduate Engineering courses prior to admission to the program; the courses are selected to meet the needs of the student on an individual basis. Students who have not had course work in Modern Physics will be required to enroll for such work at its first offering; credit for this enrollment will not be counted as part of the required number of hours for the M.S.N.E. degree. A student is admitted to candidacy for the Master of Science in Nuclear Engineering only on formal written application after he has completed 12 hours of graduate work in the program at West Virginia University with a grade-point average of 3.0 or better.

Courses. The required courses are Nuclear Engineering 390, 391, 392, and 393. Additional courses in mathematics, physical science, and engineering are selected to meet the needs of the student on an individual basis.

Thesis Supervision. Each student will be assigned to a thesis supervisor who will serve as chairman of his advisory and examination committee.

Thesis. A thesis is normally required of candidates for the M.S.N.E. degree. A maximum of 6 semester hours credit in research (N.E. 397) is usually devoted to thesis preparation. However, the thesis is not automatically approved after the required number of semester hours of research work have been completed. The thesis must conform to the general requirements of the Graduate School.

Final Examination. The candidate for the M.S.N.E. degree shall submit to an oral or written examination by his advisory and examining committee. The examination may cover all course material and the thesis.

The Nuclear Engineering curriculum is approved for participation in the Atomic Energy Commission Special Fellowship Program, and the program is administered by the Department of Chemical Engineering.

Facilities. The specialized facilities for Nuclear Engineering include a swimming pool reactor, a subcritical reactor, electronic nuclear reactor simulator, graphite sigma pile, 50,000 curie and 1,000 curie cobalt-60 irradiators, and a modern radioisotopes laboratory for instruction and research. The various departments in the College of Engineering are also well equipped for a variety of research projects which are applicable to the field of nuclear technology.

THE DEGREE OF DOCTOR OF PHILOSOPHY

H. P. SIMONS, *Program Director*

Candidates for the degree of Doctor of Philosophy are urged to complete requirements for the Master's degree although application for the doctoral program may be made after at least 12 hours of graduate work with a grade-point average of at least 3.0 have been completed. A qualifying examination will be required.

For chemical engineering majors completing the M.S.Ch.E. degree, the requirements include the completion of either the Ch.E. 323-324 or the 372-373 sequence together with an additional 4 hours of Ch.E. 310-311. In order to attain depth of study in chosen areas, work in Ch.E. 300 and Ch.E. 380 will be necessary together with a sufficient number of hours of Ch.E. 397 to complete the dissertation.

Candidates holding the M.S.E. in chemical engineering will be required to complete Ch.E. 302-304-306-307 and to present 6-hour blocks in concomitant science as listed under the M.S.E. degree.

Doctoral programs in the Materials Science and Nuclear Engineering areas will be broadly interdisciplinary in nature, and each program will be arranged on an individual basis in consultation with the College of Engineering Graduate Executive Committee. Seminars and advanced independent study will be used freely to provide depth in specialization together with the necessary hours of research.

The research work for a doctoral dissertation should show a high order of originality on the part of the student and must offer an original contribution to the field of engineering science. It must have good literary form and style, and must give a thorough survey of the prior art with acceptable standards of documentation. Upon completion of the dissertation, the candidate is required to take a final oral examination. This examination is designed to bring out the candidate's logic, critical ability, and reasoning power, and is based upon the field covered by the dissertation.

CHEMICAL ENGINEERING

201. CHEMICAL ENGINEERING FUNDAMENTALS. 3 hr. PR: T.A.M. 101, T.A.M. 104, Math. 140. Review of vector and tensor algebra; viscosity; method of shell balances; equations of continuity, motion, and energy; Navier-Stokes equation; turbulent flow; flow through porous media; microscopic momentum balances; boundary layer; heat conduction in solids; convective heat transfer; boiling and condensation; radiation; diffusion of mass; film and penetration theory; analogies among heat, mass, and momentum transfer. 3 hr. rec.
202. CHEMICAL ENGINEERING FUNDAMENTALS. 3 hr. Continuation of Ch.E. 201. 3 hr. rec.
210. PROCESS ENGINEERING. 3 hr. PR: Ch.E. 202 or consent. Process equipment calculations for unsteady state. Determination of maximum and minimum process conditions. Economics of processing methods. 3 hr. rec.
224. PROCESS DEVELOPMENT. 3 hr. PR: Chem. 238 and 261, Ch.E. 202 and 243. Development of process systems from the unit operations-unit process concept. Use of thermodynamics and kinetics in the evaluation of system requirements and performance. 3 hr. rec.
242. CHEMICAL ENGINEERING THERMODYNAMICS AND KINETICS. 3 hr. PR: Chem. 261. Material and energy balances; internal energy levels; statistical distributions and statistical evaluation of thermodynamic functions; empirical evaluation of thermodynamic functions; second law of thermodynamics; thermodynamic properties of solutions and solid phases; chemical and physical

equilibria Kinetics of simple and complex chemical reactions; development of rate equations. Kinetics of vapor phase-catalytic reactions; development of rate equations and mechanisms of reactions; back mixing. 3 hr. rec.

243. CHEMICAL ENGINEERING THERMODYNAMICS AND KINETICS. 3 hr. Continuation of Ch.E. 242. 3 hr. rec.

270, 271. CHEMICAL ENGINEERING PROFESSIONAL BLOCK. 9 hr. each. PR: Completion of all technical courses prescribed for the first three years. Professional aspects of Chemical Engineering involving analysis, synthesis and design, process dynamics, design of experiments, materials engineering, design and computation laboratories, and seminar on engineering practice and ethics. Includes a comprehensive plant design project. Thirty-five hours per week divided between lecture, recitation, computation and experimental laboratory. The Engineer-in-Training examination is required.

280. CHEMICAL ENGINEERING PROBLEMS. 1-6 hr. For junior, senior, and graduate students. May be used to correct deficiencies preparatory to or following courses such as Ch.E. 270 and 271 or for students in other disciplines desiring to take only a portion of a course.

240. INDUSTRIAL INSTRUMENTATION AND CONTROL. 3 hr. PR: Math. 140. Discussion of process characteristics, theory and application of measuring technics. Theory, modes and application of automatic control. Selection and characteristics of final control elements. 3 hr. rec.

297. THESIS. 2-5 hr. A problem in chemical engineering or industrial chemistry is selected for investigation. A carefully prepared report is required. Open only to qualified seniors. 6-15 hr. lab.

300. CHEMICAL ENGINEERING SEMINAR. 1-6 hr. Includes such topics as statistical and non-equilibrium thermodynamics, physico-chemical hydrodynamics, optimization, rheology, heterogeneous reactors, and fast-reaction kinetics. Other topics may be included consistent with demand and changing requirements.

302. ADVANCED HEAT TRANSFER. 2-5 hr. PR: Math 140 and consent. Theory of steady and transient conduction, radiation heat transfer, dimensional analysis and analogy, natural convection, forced convection, heating and cooling inside and outside tubes, finned tubes and compact heat exchangers, packed and fluidized system heat transfer, heat transfer in condensing vapor, heat transfer in boiling liquids and evaporation, high velocity flow heat transmission, application to process heat transfer and design. 3 hr. rec., 0-6 hr. lab.

304. ADVANCED MASS TRANSFER. 2-5 hr. PR: Math. 140 and consent. Theory of diffusion, interphase mass transfer theory, simultaneous mass and heat transfer, principles of design, equipment survey, mechanical operations, mass transfer performance, scale-up practices, mass transfer in solid-gas and solid-solid phases, liquid-liquid extraction. 3 hr. rec., 0-6 hr. lab.

306. ADVANCED FLUID DYNAMICS. 2-5 hr. PR: Math. 140 and consent. Vector and tensor analysis, differential equations of fluid flow, flow of nonviscous fluid, laminar flow, turbulent flow, analogy between fluid momentum, mass and heat transfer, dimensional analysis, the laminar sublayer, flow of fluid past immersed bodies, fluid dynamics of particle suspensions, flow of fluids through porous media, non-Newtonian fluid flow. 3 hr. rec., 0-6 hr. lab.

307. ADVANCED DISTILLATION. 2-5 hr. PR: Math. 140 and consent. Advanced study of vaporization principles of separation of liquid mixtures, steam, batch, continuous, azeotropic, extractive, and molecular distillation. 3 hr. rec., 0-6 hr. lab.

310, 311. ADVANCED CHEMICAL ENGINEERING LABORATORY. 2-4 hr. each. PR: Consent. Design, construction, operation and supervision of specialized equipment for obtaining engineering data. Design of engineering experiments, data processing, and reporting including evaluation of performance.

323, 324. ADVANCED PROCESS DEVELOPMENT. 3 hr. PR: Consent. Use of extended and generalized unit process and unit operation concepts; specialized synthetic

methods; reaction mechanisms and their effects on equipment design and performance; study of properties, their evaluation, prediction and marketability; industrial toxicology and plant safety. 3 hr. rec.

341. MATHEMATICAL METHODS IN CHEMICAL ENGINEERING. 3 hr. PR: Math. 140. Emphasis is placed upon the formulation of the differential and difference equations, both ordinary and partial, governing chemical engineering operations. Analytic and numerical techniques used for their solutions include transform methods. 3 hr. rec.

344. ADVANCED CHEMICAL ENGINEERING THERMODYNAMICS. 3 hr. PR: Consent. Review of thermodynamic transformations; advanced applications to chemical and physical equilibria; development and applications of phase rule; equilibria diagrams for nonideal systems; determination and use of activity coefficients; methods of estimating thermodynamic functions; introduction to statistical mechanics. 3 hr. rec.

345. ADVANCED CHEMICAL ENGINEERING KINETICS. 3 hr. PR: Consent. Applications of chemical kinetics to industrial reactor design; review of physico-chemical principles; theories of reactions; design of batch and flow reactors; theories of catalysis; reactor mechanisms; data interpretation; applications to design of catalytic reactors, effects of diffusion on catalytic reactions. 3 hr. rec.

372, 373. ADVANCED CHEMICAL ENGINEERING DESIGN. 3 hr. each. PR: Consent. Critical analysis and evaluation of equipment design procedures. Advanced aspects of plant layout with particular emphasis upon the systems approach. 3 hr. rec.

380. ADVANCED INDEPENDENT STUDY. 1-6 hr. PR: Consent. Designed to increase the depth of study in a specialized area of chemical engineering.

383. ADVANCED SYSTEMS ENGINEERING. 3 hr. PR: Consent. Control systems and the feed-back concept, transfer functions and mathematical analysis of dynamic equations, transient analysis and stability of control systems, frequency response of control systems, thermal process dynamics, mass transfer dynamics, chemical process dynamics, use of analog computer for study of system behavior, non-linear systems and adaptive control, random response and filtering of noise. 3 hr. rec.

397. RESEARCH. 1-15 hr. Suitable problem in chemical engineering.

MATERIALS SCIENCE ENGINEERING

250. ENGINEERING MATERIALS SCIENCE. 3 hr. PR: Physics 112. Includes a study of the internal structures of metals, ceramics, and organic materials and the dependence of properties upon these structures. Also included is the behavior of materials under conditions involving mechanical stresses, thermal reactions, corrosion, electromagnetic fields and radiation. 3 hr. rec.

263, 264. PRINCIPLES OF MATERIALS ENGINEERING. 3 hr. each. PR or conc: Mat.E. 250. Theory and fundamental principles involved in the development and production of engineering materials from their basic sources. Recommended for non-majors. 3 hr. rec.

300. MATERIALS SCIENCE SEMINAR. 1-6 hr. PR: Consent. Includes such topics as high temperature materials, states and properties of matter, thermodynamics of solids including ceramics, alloys and synthetics, imperfections in solids, thin films and semi-conductors. Other subjects may be included consistent with demand and changing requirements.

356, 357. SCIENCE OF ENGINEERING MATERIALS. 6 hr. each. PR: Consent. The scientific aspects of matter, principally the solid state including the equilibrium principles and properties, the nonequilibrium processes, reaction theory, bonding and structure, rheological phenomena and the aspects of corrosion, degradation of materials, and radiation effects. 6 hr. rec.

358, 359. MATERIALS SCIENCE LABORATORY. 3 hr. each. PR: Consent. Preparation, examination, and evaluation of properties of engineering materials. Particular

emphasis is placed upon the relationship of chemical, crystallographic, and physical structure to the properties of materials and to the development of materials with special properties. 9 hr. lab.

380. ADVANCED INDEPENDENT STUDY. 1-6 hr. PR: Consent. Designed to increase the depth of study in a specialized area of materials science. Non-majors may take portions of Mat.E. 356-457 under this number.

397. RESEARCH. 1-15 hr.

NUCLEAR ENGINEERING

290. INTRODUCTORY NUCLEAR ENGINEERING. 3 hr. PR: Physics 124. Includes elementary nuclear physics necessary for understanding nuclear engineering. Design and operation of nuclear reactors, shielding, instrumentation, health physics, fuel cycles, uses of radioactive isotopes, nuclear propulsion. 3 hr. rec.

300. NUCLEAR ENGINEERING SEMINAR. 1-6 hr. PR: Consent. Includes such topics as the kinetics of boiling water reactors, breeder reactor concepts, fast reactor systems, pulsed reactor systems, radiation chemistry, and space nuclear power systems. Other topics may be included consistent with demand and changing requirements.

380. ADVANCED INDEPENDENT STUDY. 1-3 hr. Special studies in fuel reprocessing, shielding, reactor technology, and related areas.

390. ANALYSIS OF NUCLEAR ENERGY SYSTEMS. 3 hr. PR or conc: Physics 225 or equiv., and Physics 287 or equiv. Probability concepts and nuclear cross sections. Multiplication constant and neutron flux. Diffusion theory. Homogeneous reactors: one group theory; multigroup theory. Heterogeneous reactors. Reflected reactors. Reactor kinetics. Control rod theory. Special considerations in analysis of hydrogenous systems. 3 hr. rec.

391. PRINCIPLES OF NUCLEAR REACTOR ENGINEERING. 3 hr. PR: Nuc.E. 390. Thermal analysis of reactor systems. Shielding. Fuel element design. Reactor poisons. Instrumentation. Economics of nuclear systems. Radiation, protection. Legal aspects. Radioactive waste disposal. 3 hr. rec.

392. INTERACTION OF RADIATION AND MATTER. 3 hr. PR or conc: Physics 225. Radiation damage models, effects of nuclear radiations on reactor components and other materials, experimental techniques. Industrial applications: process control, polymerization, sterilization, pasteurization. 3 hr. rec.

393. NUCLEAR LABORATORY. 1-6 hr. PR or conc: Nuc.E. 390 or equiv. Techniques of radiation measurements. Determination of neutron properties; diffusion length, albedo, etc. Exponential reactor parameters. Reactor simulation. Experiments with swimming pool reactor and cobalt-60 radiation facility. Dosimetry, 1 hr. rec., 6 hr. lab.

CIVIL ENGINEERING

MASTER OF SCIENCE IN CIVIL ENGINEERING

Students must comply with rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

Courses. No rigid curriculum is prescribed for the degree of Master of Science in Civil Engineering. Graduate level work in mathematics and mechanics is customary and at least 15 hours should be selected from civil engineering courses numbered 300 or above.

Thesis. A thesis is normally required of candidates for the M.S.C.E. degree. A maximum of 6 semester hours credit in research (C.E. 397) is usually devoted to thesis preparation. However, the thesis is not automatically approved after the required number of semester hours of research work have been completed. The thesis must conform with the general requirements of the Graduate School and with any additional requirements established by the Department of Civil Engineering.

At the discretion of the student's advisory committee a non-thesis program may be established in which either a comprehensive problem or additional course work is substituted for the thesis.

Final Examination. The candidate for the M.S.C.E. degree shall be given an oral or written examination by his advisory and examining committee. The examination shall cover all course material and the thesis, if one is required.

THE DEGREE OF DOCTOR OF PHILOSOPHY

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in General Requirements for graduate work in the College of Engineering. A program designed to meet the needs and objectives of each student will be developed in consultation with the student's committee.

The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the art and science of civil engineering. The dissertation must have good literary form and style and must present a thorough review of the prior study in the subject with acceptable standards of documentation. The candidate is required to take a final oral examination upon completion of the dissertation. This examination is designed to permit the candidate to demonstrate his ability to present and defend his work orally in a logical manner.

CIVIL ENGINEERING

210. **PHOTOGRAMMETRY.** 3 hr. PR: C.E. 102. Geometry and interpretation of the aerial photograph; flight planning; radial-line control; principles of stereoscopy; plotting instruments. 2 hr. rec., 3 hr. lab.
211. **GEODESY.** 3 hr. PR: C.E. 102 and Math. 16. Precise base line measurements, triangulation and leveling, geodetic astronomy; figure of the earth, map projections; rectangular coordinate systems; least squares adjustment; gravity. 3 hr. rec.
221. **ENGINEERING HYDRAULICS.** 3 hr. PR: C.E. 115. Fundamental principles of flow, similitude, flow measurement, water hammer and surging, channel transitions, gradually varied flow, wave motion and sediment transportation. Design of various elements of hydraulic structures. 2 hr. rec., 3 hr. lab.
222. **OPEN CHANNEL FLOW.** 3 hr. PR: C.E. 115. An analysis of the hydraulic problems associated with natural waterways, man-made waterways, and the design of the hydraulic structures of open channels. 3 hr. rec.
231. **CONCRETE AND AGGREGATES.** 3 hr. PR: C.E. 131, T.A.M. 103. Considerations and methods for the design of concrete mixes. Effect of air entraining agents and other additives. Studies of the influence of aggregate properties on the design and performance of concrete mixtures. An analysis of the methods of test commonly used for concrete and aggregates and the significance of these tests. 3 hr. rec.
232. **PRINCIPLES OF TRANSPORTATION ENGINEERING.** 3 hr. PR: C.E. 131 or consent. A basic approach to the problem of integrated transportation systems from the standpoint of assembly, haul, and distribution means. Analysis of the characteristics of the transport equipment and traveled way. Power requirements, speed, stopping, capacity, costs, economics of location and route selection will be discussed. Future technological developments and innovations will be considered. 3 hr. rec.
233. **CONSTRUCTION METHODS.** 3 hr. PR: C.E. 131 or equiv. The study of construction methods, equipment, and administration with particular emphasis on the influence of new developments in technology. 2 hr. rec., 3 hr. lab.
251. **PUBLIC HEALTH ENGINEERING.** 3 hr. PR: C.E. 146 or 147 or consent. The engineering aspects involved in the control of the environment for the protection of the health and the promotion of the comfort of man. Discussions will include communicable disease control, milk and food sanitation, air pollution, refuse disposal, industrial hygiene, and radiological health hazards. 3 hr. rec.
252. **WATER RESOURCES ENGINEERING.** 3 hr. PR: C.E. 115. The design of water-resource systems. The interrelationship between economic objectives, engineering analysis, and governmental agencies. 3 hr. rec.

260. **STRUCTURAL ANALYSIS II.** 3 hr. PR: C.E. 160. An introduction to the fundamental theory of statically indeterminate structures. General theory of continuity and iterative and energy methods applied to the analysis of indeterminate beams and frames. 3 hr. rec.

261. **STATICALLY INDETERMINATE STRUCTURES.** 3 hr. PR: C.E. 260. Advanced topics in indeterminate structural analysis for trusses and nonprismatic members. 3 hr. rec.

270. **STRUCTURAL DESIGN I.** 3 hr. PR or conc: C.E. 260. Theory and design of reinforced concrete members. Design considerations for concrete bridges and buildings. 2 hr. rec., 3 hr. lab.

271. **STRUCTURAL DESIGN II.** 3 hr. PR or conc: C.E. 260. Design of steel bridge and building structures. Welded, riveted, and bolted connections; simple and moment-resistant connections; cost estimates. 2 hr. rec., 3 hr. lab.

272. **PLASTIC DESIGN OF STEEL STRUCTURES.** 3 hr. PR: C.E. 260 or consent. The fundamental concepts of the plasticity of steel. Analysis of structures for ultimate load. The influence of axial forces, shear forces, and local buckling on the plastic moment. Study of structural connections and deflections. Steel structure design. 3 hr. rec.

273. **PRESTRESSED CONCRETE.** 3 hr. PR: C.E. 270. The analysis and design of determinate and indeterminate prestressed beams and frames. 3 hr. rec.

274. **TIMBER DESIGN.** 3 hr. PR: C.E. 160 and Forestry 232. Emphasis on the fundamentals of modern timber design and analysis. Topics to be presented include a review of wood properties, the design of beams, columns, arches, trusses, and pole structures using dimensional lumber, glue-laminated and plywood components. Detailed study of connections using nails, shear connectors, and adhesives. 3 hr. rec.

275. **REINFORCED CONCRETE.** 3 hr. PR: C.E. 160. Theory and design of slabs, beams, columns, footings, retaining walls, and concrete buildings, with emphasis on ultimate load design. 2 hr. rec., 3 hr. lab.

280. **SOIL MECHANICS.** 3 hr. PR: C.E. 115, T.A.M. 101. Origins and distribution of soils, classification of soils, fundamental soil properties and stresses in soils. Subsurface exploration. Introduction to foundations design and the design and construction of earth structures. 2 hr. rec., 3 hr. lab.

281. **FOUNDATIONS ENGINEERING.** 3 hr. PR: C.E. 131, 280. Soils exploration and the design and analysis of engineering foundations. Particular emphasis on earth pressures and the design of retaining walls, studies of bracing systems and the elements of shallow and deep foundations for bridges and buildings. Movement of water through soil structures and control of water in excavations. 3 hr. rec.

290. **CIVIL ENGINEERING PROBLEMS.** 1-4 hr. For junior, senior, and graduate students.

301. **GEOTECHNIC.** 3 hr. PR: Consent. A presentation of a unified approach to the various aspects of soil formation and the influence of the formative factors on the nature of soils and their use as engineering materials. Presented cooperatively with the Department of Agronomy and the Department of Geology. 3 hr. rec.

315. **ADVANCED FLUID MECHANICS.** 3 hr. PR: C.E. 115. Compressible and noncompressible flow, flow with friction and heat transfer, boundary layer flow, fluid machines, unsteady flow and fluid vibration. 3 hr. rec.

321. **HYDRAULIC STRUCTURES.** 3 hr. PR: C.E. 221 or consent. The hydraulic analysis and design of engineering structures such as reservoirs, dams, spillways, gates, and outlet works. The study of hydraulic machinery, irrigation, hydroelectric power, drainage and flood control. 3 hr. rec.

330. **BITUMINOUS MATERIALS AND MIXTURES.** 3 hr. PR: C.E. 131. Manufacture and testing of bituminous materials. Significance of tests and specifications of

bituminous materials. Principles of the design of bituminous mixtures, including methods of test and the influence of aggregate, temperature, and other variables upon design for stability and durability. Production of bituminous mixtures and construction practice in utilizing these mixtures. 2 hr. rec., 3 hr. lab.

- 331. **PAVEMENT DESIGN.** 3 hr. PR: C.E. 131, 280. Effects of traffic, soil, and loads on the design of pavement. Consideration of drainage and climate. Design of bases and sub-bases. Methods of design of flexible and rigid pavements. Performance of pavement surveys. 2 hr. rec., 3 hr. lab.
- 332. **HIGHWAY ECONOMICS AND ADMINISTRATION.** 3 hr. PR: Consent. Study of the methods of financing highways including federal participation. Consideration of the means of establishing allocation of highway cost and determination of economic justification of routes. Analysis of highway administrative organizations. 3 hr. rec.
- 333. **GEOMETRIC DESIGN OF HIGHWAYS.** 3 hr. PR: Consent. The theory and practice of the geometric design of modern highways. Horizontal and vertical alignment, cross-slope, design speed, sight distances, interchanges, and intersections are discussed. Critical analysis of design specifications. 2 hr. rec., 3 hr. lab.
- 334. **URBAN PROBLEMS.** 3 hr. PR: Consent. The study of the particular problems of transportation in the urban area as they relate to the general development of the city. Emphasis is on the role of the engineer in the planning for urban transportation and the relationship of the engineer to the city planner and to the city administration. 3 hr. rec.
- 335. **SURFACE AND SUBSURFACE DRAINAGE.** 3 hr. PR: Consent. The study of the nature and requirements of drainage studies and drainage design as they pertain to transportation facilities. Emphasis is on the theory of drainage design and a critical analysis of drainage practices. 3 hr. rec.
- 336. **HIGHWAY PLANNING I.** 3 hr. PR: Consent. Analysis of planning programs and methods including highway needs studies, priority rating systems, and programming methods. Consideration of traffic assignment and forecasting techniques. Devoted primarily to rural route problems. Case history method of study utilized. 3 hr. rec.
- 337. **HIGHWAY PLANNING II.** 3 hr. PR: C.E. 336. Continuation of C.E. 336 with special attention to urban locations and planning. 3 hr. rec.
- 338. **HIGHWAY LAWS.** 3 hr. PR: Consent. The analysis of existing highway laws with emphasis on those aspects particularly related to planning functions such as reservation of rights-of-way, access control, eminent domain, systems classification, and the basis for the existence and operation of various planning agencies. 3 hr. rec.
- 339. **TRAFFIC ENGINEERING CHARACTERISTICS.** 3 hr. PR: C.E. 131 or consent. The analysis of the basic characteristics of drivers, vehicles, and roadway that affect the performance of road systems. Studies of volumes, speeds, delays, intersections, interchanges, capacity, and accidents will be considered. The techniques of traffic engineering measurements, investigations and data analysis, including laboratory practice, will be included. 2 hr. rec., 3 hr. lab.
- 340. **TRAFFIC ENGINEERING OPERATIONS.** 3 hr. PR: C.E. 339. The theory and practice of the application of traffic engineering regulations, traffic flow theory, the design and use of traffic control devices and signal systems. Traffic administration and parking control will be discussed. 3 hr. rec.
- 345. **PROPERTIES OF AIR POLLUTANTS.** 3 hr. PR: Consent. Physical, chemical, biological, and social behavioral properties of dusts, droplets, and gases in the atmosphere. Air pollutant sampling and analysis. The planning and operation of air pollution surveys. 2 hr. rec., 3 hr. lab.
- 346. **AIR POLLUTION CONTROL ENGINEERING.** 3 hr. PR: C.E. 345 or consent. Study of the engineering alternatives in achieving various degrees of air pollution control. Factors that are considered in selection and specification of dust and

gas collectors and convertors for various types of operations, and the use of alternate process methods and process materials. 2 hr. rec., 3 hr. lab.

347. AIR POLLUTION CONTROL STANDARDS. 3 hr. PR: C.E. 346 or consent. Comparative study of technical, economical, and social factors used in developing and establishing air pollution standards, criteria, and control limitations. Relationships between process design specifications, pollutant emission limitations, ambient air pollution effects on people and objects, air quality standards and emission performance limitations. 2 hr. rec., 3 hr. lab.

348. AIR POLLUTION CONTROL PROGRAMS. 3 hr. PR: C.E. 346 or consent. Examination of air pollution control programs of industries and government. Rationales and patterns of organization structure and operating administrative factors, including intra-office and inter-office and other group relationships. Significance of relationship with planning fire prevention, water pollution control, building inspection, and economic development agencies. 3 hr. rec.

349. SOLID WASTE DISPOSAL. 3 hr. PR: Consent. Study of traditional patterns and problems of solid waste storage, transport, and disposal. Examination of various engineering alternatives with appropriate consideration for air pollution control, water pollution control, and land reclamation. Analytical approaches to recovery and reuse of materials. 2 hr. rec., 3 hr. lab.

350. SANITARY CHEMISTRY AND BIOLOGY. 3 hr. PR: C.E. 147, Bact. 248, or consent. Study of the physical and chemical properties of water. Theory and methods of chemical analysis of water, sewage, and industrial wastes. Biological aspects of stream pollution problems. 2 hr. rec., 3 hr. lab.

352. WATER TREATMENT THEORY. 3 hr. PR: C.E. 350. Theory of the various procedures and techniques utilized in the treatment of water for municipal and industrial use. Review of water quality criteria. Design of water purification facilities. 2 hr. rec., 3 hr. lab.

353. SEWAGE AND INDUSTRIAL WASTE TREATMENT. 3 hr. PR: C.E. 350. Theory and methods of sewage treatment. Chemical, biochemical, and physical factors related to waste treatment. Characteristics of industrial wastes and special considerations necessary for their disposal. 2 hr. rec., 3 hr. lab.

357. HYDRAULICS OF SANITARY ENGINEERING WORKS. 3 hr. PR: C.E. 221. The application of the techniques of population growth estimation, rainfall and runoff analysis, food flow, and ground water data to the design of sanitary works. Design of water distribution systems and sewerage systems. 2 hr. rec., 3 hr. lab.

358. DESIGN OF SANITARY WORKS. 3 hr. PR: C.E. 221. The investigation of water supply and waste water disposal problems. The design of waste water treatment facilities. 2 hr. rec., 3 hr. lab.

359. BASIC RADIOLOGICAL HEALTH 3 hr. PR: Consent. Fundamental theory and terminology. Environmental and occupational hazards in the nuclear field. Radioactive waste disposal. Laboratory measurements of radioactivity. 2 hr. rec., 3 hr. lab.

360. STATICALLY INDETERMINATE STRUCTURES. 3 hr. PR: C.E. 260 or consent. General theory of continuity, iterative, and classical methods of analysis of skeletal structures with emphasis on the influence coefficient method. 3 hr. rec.

361. BRIDGE ENGINEERING. 3 hr. PR: C.E. 360. Statically indeterminate trusses; continuous trusses; steel and concrete arches; long-span and suspension bridges; secondary stresses. 3 hr. rec.

362. NUMERICAL METHODS OF STRUCTURAL ANALYSIS. 3 hr. PR: C.E. 261 or 360. Methods of successive approximations and numerical procedures for the solution of structural problems. Application of these procedures to the analysis of bridges and buildings. 3 hr. rec.

363. INTRODUCTION TO STRUCTURAL DYNAMICS. 3 hr. PR: Math. 140 and C.E. 261 or 360. General theory for dynamic response of systems having one or several degrees of freedom. Emphasis on the application of dynamic response theory to structural design. 3 hr. rec.

373. **STRUCTURAL DESIGN FOR DYNAMIC LOADS.** 3 hr. PR: C.E. 363 or consent. Nature of dynamic loading caused by earthquakes and nuclear weapon blasts; nature of dynamic resistance of structural elements and structural systems; criteria for the design of blast-resistant structures; criteria for the design of earthquake-resistant structures; simplified and approximate design methods 3 hr. rec.

374. **BEHAVIOR AND ADVANCED DESIGN OF TIMBER STRUCTURES.** 3 hr. PR: C.E. 260, C.E. 274, Forestry 232 or consent. A study of the behavior and analysis of structural systems and components fabricated from timber. Topics to include the behavior of timber members subjected to bending, shear, and compression, impact and vibration. An evaluation of the time dependent characteristics of timber members under load. The analysis and design of special timber structures including lamella roofs, stressed skin and prestressed members, and space frames. 3 hr. rec.

375. **REINFORCED CONCRETE DESIGN.** 3 hr. PR: C.E. 270. Theories of action of beams, slabs, and columns of reinforced concrete; review of standard codes and specifications and their influence on design. 3 hr. rec.

376. **BEHAVIOR OF REINFORCED CONCRETE MEMBERS.** 3 hr. PR: C.E. 270 or consent. Studies of the actual behavior and strength of reinforced concrete members by critically reviewing experimental and analytical investigations. Beams subjected to pure flexure, columns subjected to axial compression; combined flexure and compression; combined flexure, shear, and bond. 3 hr. rec.

377. **BEHAVIOR OF REINFORCED CONCRETE STRUCTURES.** 3 hr. PR: C.E. 376. Continuation of C.E. 376. Studies of behavior and strength of statically indeterminate reinforced concrete structures. Comparison with reinforced concrete codes and specifications. 3 hr. rec.

378. **THIN SHELL ROOF STRUCTURES I.** 3 hr. PR: Math. 140, C.E. 261 or consent. Emphasis on the development and solution of the fundamental elastic equations for barrel vault roofs using matrix algebra. Study of the effects of edge members upon the strength and stiffness of barrel vault roofs. Design of simple shell structures. 3 hr. rec.

379. **THIN SHELL ROOF STRUCTURES II.** 3 hr. PR: C.E. 378 or consent. A continuation of C.E. 378. Analysis of multiple cylindrical shells using the theory of elasticity and matrix algebra. Ultimate load and variational methods in shell analysis. Design and analysis of doubly curved shells. 3 hr. rec.

380. **SOIL PROPERTIES AND BEHAVIOR.** 3 hr. PR: Consent. A study of soil mineralogy and the physico-chemical properties of soils and their application to an understanding of the behavior of soils. Included is a detailed review of the basic and classical theories of permeability, consolidation, shear strength, and compaction. The prediction of the engineering behavior of soils is viewed in light of physico-chemical concepts. 3 hr. rec.

381. **SOIL TESTING.** 3 hr. PR: C.E. 280 or consent. Designed to complement and expand the material covered in C.E. 380 from an experimental standpoint. Experimental studies will be conducted to demonstrate empirical and theoretical principles. Emphasis will be placed on the proper interpretation of experimental results and the application of such results to practical problems. 1 hr. rec., 6 hr. lab.

382. **FOUNDATION ENGINEERING.** 3 hr. PR: C.E. 380 or consent. Application of the principles of theoretical soil mechanics to the design of shallow and deep foundations. Detailed attention is given to methods of sub-surface exploration, spread footings and mats, pile foundations, retaining walls, sheet pile structures and braced cofferdams. Particular emphasis is given to economy and performance in the selection of foundation treatment. 3 hr. rec.

383. **EARTHWORK DESIGN.** 3 hr. PR: C.E. 380 or consent. Application of the principles of theoretical soil mechanics to the design of embankments of earth and rock. Detailed attention is given to compaction methods and equipment, the

stability of natural and man-made slopes, embankment foundation stability and the design of earth and rockfill dams. 3 hr. rec.

384. GROUNDWATER AND SEEPAGE. 3 hr. PR: Consent. The flow of ground-water through soils and its application to the design of highways and dams and to construction operations. Particular emphasis is placed on the analytical solution of seepage problems. The classical flow net techniques for solving seepage problems are also given detailed consideration. 3 hr. rec.

385. AIRPHOTO INTERPRETATION. 3 hr. PR: Graduate standing. A study of airphoto interpretation techniques to obtain qualitative information concerning the extent, type, and engineering characteristics of surficial materials. Emphasis will be placed on the use of airphoto interpretation for the location of construction materials and the evaluation of engineering problems associated with the different materials that are encountered in the design and location of engineering facilities.

386. SOIL DYNAMICS. 3 hr. PR: C.E. 380 and consent. The fundamental behavior of soils subjected to dynamic loads produced by explosion effects, earthquake effects, and foundation vibrations. Particular emphasis is placed on the stress-strain-time behavior of soils for conditions of rapid stress or strain change. Consideration is given to wave propagation resulting from ground motions. The theories of vibration of a mass resting on an elastic half-space are applied to foundations vibration problems. 3 hr. rec.

390. ADVANCED DESIGN PROBLEMS. 2-6 hr. A design or investigation of any assigned problem related to civil engineering.

395. SEMINAR. 1-2 hr. PR: Consent. Studies and group discussion of structural fluid mechanics, surveying, transportation, soil mechanics and foundations, and sanitary problems.

397. RESEARCH. 1-15 hr. per sem. Original report or investigation on some topic in the civil engineering field.

ELECTRICAL ENGINEERING

MASTER OF SCIENCE IN ELECTRICAL ENGINEERING

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

Thesis. Normally a thesis is required of all candidates for the degree of Master of Science in Electrical Engineering. Approval by the Advisory and Examining Committee is necessary before the thesis will be accepted. The thesis must be presented in a form that conforms to general requirements of the Graduate School, and in addition should conform to additional thesis requirements of the department.

Whether or not a thesis is required shall be determined by the department and shall be recorded in the student's file as a part of his planned program.

Final Examination. Each candidate for the Master's degree shall pass a final examination administered by his Advisory and Examining Committee. This examination may be written or oral or both and shall cover the course material. If a thesis has been required, the examination shall also cover the thesis.

Courses. The following grouping of courses is given as a guide for selecting a graduate program leading to the degree of Master of Science in Electrical Engineering.

Group I. *Required of all candidates*

Hr.

E.E. 300. Seminar (2 semesters)	1
E.E. 325. Advanced Linear Circuit Analysis	3
E.E. 326. Advanced Electric and Magnetic Field Theory	3

Group II. *Major (Minimum of 6 hours of electrical engineering courses in the 300 series other than Group I)*

Group III. *Minor (6 hours required)*

Approved sequence of Mathematics or Physics.

In order to meet the minimum requirements for the degree of Master of Science in Electrical Engineering additional courses may be taken from the following, subject to the approval of the student's Advisory and Examining Committee:

1. Courses in the 200 series which are not required for the degree of Bachelor of Science in Electrical Engineering at West Virginia University.

2. West Virginia University courses in the 300 series.

Students with a B.S.E.E. degree from other ECPD accredited departments may be required to take some electrical engineering courses in the 200 series as prerequisites for graduate courses. If these courses are normally required for the B.S.E.E. at West Virginia University, they will not be accepted for credit in a Master's Degree program without approval of the student's Advisory and Examining Committee.

THE DEGREE OF DOCTOR OF PHILOSOPHY

A candidate for the degree of Doctor of Philosophy must comply with all requirements of the Graduate School and with the rules and regulations as outlined in "A Guide to the Graduate Program in Engineering" for graduate work in the College of Engineering. A program designed to meet the needs and objectives of each student will be developed in consultation with the student's committee. In addition, the following will be required by the department:

1. In general, requirements for the M.S.E.E. degree must be fulfilled. These requirements are outlined above.

2. Candidates for the Ph.D. degree who have been admitted with an M.S. degree from other institutions must satisfy the departmental course requirements for the M.S.E.E. degree.

3. A Ph.D. degree candidate will normally be required to take a minimum of six hours in his minor field. A minimum of three of these hours must be at the 300 level.

ELECTRICAL ENGINEERING

200. SEMINAR. (Credit). Senior standing. Special material and projects.

205. ELECTRICAL FUNDAMENTALS. 4 hr. PR: E.E. 105. Fundamentals and operating characteristics of electrical machines and transformers. Electron tube, phototube, and transistor characteristics. Electronic circuits. (Not open to electrical engineering students.) 3 hr. rec., 3 hr. lab.

210. ELECTRONICS FOR SCIENTISTS. 3 hr. PR: General Physics and Calculus or consent. A special course for chemists, physicists, medical researchers and other research workers having a limited background in electronics. The material covered will begin with electrical and electronic fundamentals and leads systematically into servomechanisms, operational amplifiers, digital circuits, and other devices used in current laboratory research and control problems. (Not open to Engineering students.) 1 hr. rec., 6 hr. lab.

225. ELECTRIC CIRCUITS III. 4 hr. PR: E.E. 125. Distributed circuits (transmission lines) steady state analysis of disturbed circuits, simulation of distributed circuits by lumped parameter circuits. Interpretation of transmission line as general four terminal network (A B C D constants), matrix methods of combination of four terminal networks, introduction of "modern" network analysis. 3 hr. rec., 3 hr. lab.

226. ELECTROMAGNETIC FIELDS. II. 3 hr. PR: E.E. 126. Plane wave in dielectric media; plane waves in conducting media; transmission lines; wave guides; antennas. 3 hr. rec.

232. ELECTROMECHANICAL DEVICES I. 4 hr. PR: E.E. 225, 226. Fundamentals of electromechanical energy conversion. Transformers and rotating machines. 3 hr. rec., 3 hr. lab.

233. ELECTROMECHANICAL DEVICES II. 4 hr. PR: E.E. 232. Analysis of machine-performance by the principles of electromechanical energy conversion. 3 hr. rec., 3 hr. lab.

235. ELECTRICAL MACHINERY. 3 hr. PR: E.E. 233 or consent. Synchronous machine 2-reactance theory and diagrams. Relation of actual machines to mathematical

models. Comparison of motor applications. Graphical methods of non-linear analysis; quasi-static methods of dynamic analysis. Systems of machines and block diagrams for speed, voltage, and position control. 3 hr. rec.

- 236. ELECTRICAL MACHINERY. 3 hr. PR: E.E. 233 or consent. Commutation theory of machines, d-c and a-c multiple-winding and special purpose machines; multiple machine systems. 2 hr. rec., 3 hr. lab.
- 252. ELECTRONICS II. 3 hr. PR: E.E. 152. Analysis of vacuum-tube and semiconductor power amplifiers, tuned amplifiers, oscillators, modulators, demodulators, and wave-shaping circuits. 3 hr. rec.
- 253. PHYSICAL ELECTRONICS. 3 hr. PR: E.E. 152. A study of the physical principles of electrical conduction and the application of these principles to electron emission and electronic conduction in solids, gases, and vacuums. 3 hr. rec.
- 257. TRANSISTOR CIRCUITS. 3 hr. PR: E.E. 152 or consent. Application of the basic principles of semiconductor electronics to the junction transistor. Development of the terminal properties of the junction transistor. 3 hr. rec.
- 261. NETWORKS AND FILTERS. 3 hr. PR: E.E. 225 or consent. Analysis and synthesis of networks and filters. 3 hr. rec.
- 262. ELECTRONIC AND COMMUNICATIONS LABORATORY. 2 hr. PR: E.E. 252 or consent. A study of tuned amplifiers, oscillators, modulators, wave-shaping circuits, transmission line characteristics, and special topics. 6 hr. lab.
- 264. COMMUNICATIONS ENGINEERING. 3 hr. PR: E.E. 252 or consent. Communications systems, or systems used to transmit information. The underlying principles of modern information transmission systems are stressed. Emphasis is placed upon the fundamental role of system bandwidth and noise in limiting the transmission of information. 3 hr. rec.
- 270. ENGINEERING ANALYSIS AND DESIGN. 3 hr. PR: E.E. 232, 252. Formulation and application of the method of engineering analysis based upon fundamental physical laws, mathematics, and practical engineering considerations. Emphasis is placed on the professional approach to the analysis of engineering problems. 3 hr. rec.
- 271. THEORY OF DIGITAL COMPUTERS. 3 hr. PR: Consent. An introduction to the field of digital computer design. Topics include general computer organization, number systems and number representations, design characteristics of major computer units, Boolean algebra and its application to computer design. 3 hr. rec.
- 275. PULSE TECHNIQUES. 3 hr. PR: E.E. 225, 152. An introduction to the response of electrical networks to non-sinusoidal inputs, the analysis of active networks with large signals and the circuits and techniques used in pulse and digital equipment. 3 hr. rec.
- 280. ELECTRICAL PROBLEMS. 1-3 hr. For junior, senior, and graduate students.
- 281. ELECTRICAL POWER SYSTEMS. 3 hr. PR: E.E. 226 or consent. Analysis of balanced polyphase systems, including transmission lines. Polyphase transformation. Principles of grounding and protection from lightning. 3 hr. rec.
- 282. SYMMETRICAL COMPONENTS. 3 hr. PR: E.E. 226 or consent. Analysis of polyphase systems in unbalanced and transient conditions. 3 hr. rec.
- 285. ELECTRIC-POWER TRANSMISSION AND DISTRIBUTION. 3 hr. PR: E.E. 281 or consent. Study of load flow and various other problems of power transmission; applications of phase modifiers, shunt inductors and series capacitors. 3 hr. rec.
- 286. FUNDAMENTAL OF SERVOMECHANISMS. 3 hr. PR: E.E. 225. Fundamental analysis of the servomechanisms and automatic control devices. 3 hr. rec.
- 287. INDUSTRIAL ELECTRONICS AND CONTROLS. 3 hr. PR: Consent. A study of electronic and magnetic control equipment and its application in industry. 3 hr. rec.
- 288. ANTENNAS. 3 hr. PR: Consent. Analysis and design of antenna systems. 3 hr. rec.

293. ANALOGUE COMPUTERS. 3 hr. PR: Math. 140. A study of the theory and operation of analogue computers. Amplitude scaling and time scaling on the analogue computer and application of the analogue computer to the solution of differential equations. 3 hr. rec.

299. ULTRA-HIGH FREQUENCY TECHNOLOGY. 3 hr. Study of special problems encountered at high and ultra-high frequencies. 3 hr. rec.

300. SEMINAR. 1-3 hr. PR: Consent. Discussion of research in electrical engineering and special problems.

301. ELECTRICAL POWER SYSTEMS. 3 hr. PR: E.E. 281 or consent. Transient and steady-state stability of systems. Travelling waves on transmission lines; lightning and switching surges. The principles of the application of analog and digital computers to solution of power system problems. 3 hr. rec.

310. SWITCHING CIRCUIT THEORY I. 3 hr. PR: Consent. This course together with E.E. 311 provides the basis for mathematical switching theory. Boolean algebra and related systems are developed from the postulational approach and applications to the theory of computers and automata are studied in detail. The emphasis is upon setting up of mathematical models and a careful study of their properties rather than upon logical design and/or techniques of computation. 3 hr. rec.

311. SWITCHING CIRCUIT THEORY II. 3 hr. PR: E.E. 310. This course is a continuation of E.E. 310. 3 hr. rec.

313. DIGITAL-COMPUTER ARITHMETIC I. 3 hr. PR: E.E. 271 or equiv. A detailed study of the various methods of performing binary computer arithmetic. Primary emphasis is placed on high speed, parallel, natural binary systems using the various number representations. Additional topics include serial, binary coded decimal (BCD), modular, and floating point arithmetic systems. Recent innovations in new computer systems will be discussed as publications become available. 3 hr. rec.

314. DIGITAL-COMPUTER ARITHMETIC II. 3 hr. PR: E.E. 313. A continuation of E.E. 313. 3 hr. rec.

325. ADVANCED LINEAR CIRCUIT ANALYSIS. 3 hr. PR: Consent. Systematic formulation of circuit equations. The use of operational techniques to find total solutions. Applications and characteristics of the Laplace and Fourier Transform, Applications of Matrix algebra, complex variable theory and elementary topological techniques to circuit analysis. 3 hr. rec.

326. ADVANCED ELECTRIC AND MAGNETIC FIELD THEORY. 3 hr. PR: Consent. Maxwell's equations. Electromagnetic waves. Poynting vectors, guided waves. 3 hr. rec.

327. THEORY OF GUIDED WAVES. 3 hr. PR: E.E. 326. Transverse electromagnetic waves; propagation in cylindrical waveguides; in homogeneously filled waveguides; waveguide discontinuities. 3 hr. rec.

330. ELECTRICAL MACHINERY. 3 hr. PR: E.E. 235 or consent. Advanced theory of synchronous and induction machinery following Parks-Doherty-Nickel theory; applications of matrix algebra and tensor analysis. 3 hr. rec.

348. NONLINEAR AUTOMATIC CONTROL SYSTEMS. 3 hr. PR: Consent. The application of Liapunov's and Popov's methods to nonlinear control systems, together with classical techniques. 3 hr. rec.

350. ELECTRONIC CIRCUITS. 3 hr. PR: E.E. 252. An advanced study for the analysis and design of electronic circuits; low-pass and band-pass amplifiers, single-tuned and double-tuned stages, equal ripple and maximally flat responses. 3 hr. rec.

351. PHYSICAL ELECTRONICS. 3 hr. PR: E.E. 253, 257 or consent. Application of the principles of physics to semiconducting materials, junctions between semiconductors and metals, and semiconductor junctions. The development of equivalent circuits for semiconducting devices. 3 hr. rec.

361. MODERN NETWORK SYNTHESIS. 3 hr. PR: E.E. 325. Study of the basic methods of modern network synthesis using passive devices. Develops the concept of a positive-real function and applies this and complex variable theory to network synthesis. 3 hr. rec.

364. COMMUNICATIONS THEORY. 3 hr. PR: E.E. 264, E.E. 325. Mathematical representation of signals; information measurement and channel capacity; network analysis with random signals and noise. 3 hr. rec.

366. INFORMATION THEORY I. 3 hr. PR: E.E. 364. Probability concepts; theory of discrete systems; encoding; theory of continuous systems; systems with memory; the fundamental theorem of information theory. 3 hr. rec.

367. INFORMATION THEORY II. 3 hr. Continuation of E.E. 366. 3 hr. rec.

380. ELECTRICAL PROBLEMS. 1-6 hr. For graduate students.

386. FEEDBACK SYSTEM THEORY. 3 hr. PR: E.E. 286, E.E. 325. Signal flow graphs; sensitivity; return difference; mathematical definition of feedback; effects of feedback; multiple loop systems; multivariable systems. 3 hr. rec.

387. SAMPLE-DATA CONTROL SYSTEMS. 3 hr. PR: E.E. 386 or consent. A study of control systems in which the activating signal is represented by samples at regular time intervals. 3 hr. rec.

388. SYNTHESIS OF FEEDBACK SYSTEMS I. 3 hr. PR: E.E. 364, E.E. 386. Methods of direct synthesis and optimization of feedback systems; Wiener theory; Pontryagin's maximum principle; dynamic programming; adaptive feedback systems. 3 hr. rec.

389. SYNTHESIS OF FEEDBACK SYSTEMS II. 3 hr. Continuation of E.E. 388. 3 hr. rec.

390. ADVANCED INDEPENDENT STUDY. 1-6 hr. PR: Consent. Individual investigation in advanced electrical engineering subjects that are not covered in formal courses.

391. VECTOR SPACES IN LINEAR CONTROL SYSTEMS. 3 hr. PR: Consent. Matrix theory and linear transformations as applied to linear control systems. The state-space on time-domain study of stability, controllability, observability, etc. 3 hr. rec.

397. RESEARCH. 1-15 hr. Advanced research or special investigations on some topic related to electrical engineering.

INDUSTRIAL ENGINEERING

MASTER OF SCIENCE IN INDUSTRIAL ENGINEERING

Students must comply with rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

The M.S.I.E. degree program is designed to serve the graduate needs of a person holding a B.S.I.E. degree or an Industrial Engineering option in another field of engineering. Also, a person holding a degree in another field of engineering but who is willing to essentially fulfill the requirements of a B.S.I.E. degree may elect to pursue the M.S.I.E. degree. A review of the aims and objectives of each individual will permit exact evaluation of the courses required.

There are seven core areas of study available:

- Core I—Industrial Statistics and Reliability
- Core II—Operations Research
- Core III—Computer Applications
- Core IV—Human Factors
- Core V—Systems Engineering
- Core VI—Manufacturing Processes and Tooling
- Core VII—General Industrial Engineering

Courses. No rigid curriculum is set up for the M.S.I.E. or M.S.E. degrees. At least half of the 30 hours required for either degree must be in courses in the Department of Industrial Engineering; this is exclusive of research. At least 12 hours

must be courses included in the particular core area chosen. (Exception: In Core Area VII, at least half of the 30 hours must be in the 300 number series.) A minor may be selected in another core area, in another branch of engineering, in mathematics, or in the College of Commerce.

Thesis. A thesis is usually required of all candidates for either degree and in practically all cases it will be necessary to take all of the six hours of research work (I.E. 397). A thesis, however, is not automatically approved after the required number of semester hours of research work has been completed. The thesis must be presented in a form that conforms to the general requirements of the Graduate School, and in addition must conform to the additional thesis requirements of the department.

Thesis Supervisor. Each student will be assigned to a thesis supervisor who will normally serve as chairman of his Examining and Advisory Committee.

Final Examination. On completion of his thesis and course work, the candidate will be given an oral examination by his Examining and Advisory Committee; additional examiners may be called in for this examination.

INDUSTRIAL ENGINEERING

200. METAL-CUTTING THEORY AND PRACTICE. 3 hr. PR: I.E. 100, and Ch.E. 250. Metal-cutting tools, tool materials, work materials, cutting fluids, process of chip formation, cutting forces, tool-life tests, economic tool life, measurement of product. 2 hr. rec., 3 hr. lab.
201. METAL FORMING MANUFACTURING PROCESSES. 3 hr. PR: I.E. 100 or consent. Applications and operations of the basic metal forming processes including the primary metal working processes and the metal shearing, drawing, binding, and squeezing processes, along with the machine tools required for these processes. 3 hr. rec.
205. METAL FORMING THEORY. 3 hr. PR: I.E. 201. A study of the mechanics and basics of metal forming with elementary theoretical and descriptive investigations of tube-sinking, deep-drawing, wire-drawing, extrusion, cold rolling, and forging. 3 hr. rec.
207. METAL CASTING MANUFACTURING PROCESSES. 3 hr. PR: I.E. 100 and Mat.E. 250 or consent. Fluidity processes used in industry covering non-permanent processes such as sand molding, centrifugal molding, investment molding, and shell molding. Some permanent mold methods will be investigated along with metal melting processes, molding machines, and fundamentals of costing design. 3 hr. rec.
211. INDUSTRIAL ENGINEERING PROBLEMS. 1-3 hr. PR: I.E. 140, and senior standing. Special problems relating to industrial engineering.
- *214. ADVANCED ANALYSIS OF ENGINEERING DATA. S. 3 hr. PR: I.E. 244. The application of advanced theories of statistical techniques to analyze and interpret industrial problems. Subjects include multiple regression, curvilinear regression, advanced analysis of variance, randomized complete blocks, Latin Square designs, factorial designs, transformations, and analysis of response curves. Accent is on proper design of experiments, proper interpretation of results, and thorough consideration of all errors of estimation and errors of inference. 3 hr. rec.
- *215. STATISTICAL DECISION MAKING. 3 hr. PR: I.E. 244 or consent. Probability relating to decision processes and essential logic in the applications of statistics and how management can recognize situations in which it will be profitable to employ them. 3 hr. rec.
229. DESIGN OF DYNAMIC MATERIAL SYSTEMS. 3 hr. PR: I.E. 140, 142 or consent. The application of Industrial Engineering theory and practice to the selection of material systems and equipment. This is to include the efficient handling of materials from the first movement of raw materials to the final movement of finished product. Present quantitative design techniques will be included. 3 hr. rec.

*Courses may be taken as undergraduate work by students in Colleges and Schools other than the College of Engineering.

*244. ENGINEERING STATISTICS. 3 hr. PR or conc: Math. 117. The use of graphical analysis; measures of central tendency and dispersion; normal, binomial, and Poisson distributions in engineering applications; linear regression and correlation; tests of significance, nonparametric statistics, and analysis of variance. 3 hr. rec.

*250. ELECTRONIC COMPUTER DATA PROCESSING. 3 hr. PR: Senior standing. Fundamentals of digital computer operations, equipment characteristics, input and output components. Elements of number systems. Fundamentals of "IR" information retrieval. Emphasis is placed on integrated systems analysis and design, business and industrial data for computer applications, and fundamentals of programming. Existing equipment systems and the economics of their applications will be reviewed.

253. ANALYTICAL TECHNIQUES OF OPERATIONS RESEARCH. 3 hr. PR: I.E. 244. A study of the analytical techniques used in operations research and industrial engineering with special emphasis on their application to industrial systems and operations. The applications of matrix algebra, vectors and convex set theory to linear programming. Minimization techniques including differencing, differentiation of single and multiple integrals and Lagrangian multipliers with application to production and inventory problems. Calculus of finite differences and Markov Processes with applications to production problems and decision making. 3 hr. rec.

*254. INTRODUCTION TO OPERATIONS RESEARCH. 3 hr. PR: I.E. 244, and conc: I.E. 142 or consent. Economic problems of production management, schematic models, linear programming, total value analysis, incremental analysis, Monte Carlo analysis, and equipment investment analysis. 3 hr. rec.

256. INTRODUCTION TO SYSTEMS ENGINEERING. 1 hr. PR: I.E. 214; conc: I.E. 254, I.E. 287. The nature of scientific methodology including: quantitative synthesis of models with accompanying objectives and restrictions, definition of terms, sampling and measurements of components of the model, development and testing of assumptions, optimization techniques, testing and controlling the model and the solution, and error sensitivity of the model. Emphasis will also be toward development of the problem—solver's ability to successfully assign resources to the problem solution phases in a manner such as to equalize the marginal cost of improving the model's reliability. This course will provide an opportunity for the student to analyze an operation as it may interact with the whole system. 1 hr. rec.

*281. DIGITAL COMPUTATION FOR ENGINEERS. 3 hr. Conc.: Math. 116. Study of processes of broadly integrating the digital computer into service for the engineer or scientist and study of the programming process with emphasis on coding with the automatic programming language Fortran. Considerable use will be made of the Computer Center equipment, especially the IBM 7040-1901 combination. Various other programming languages such as COBOL and ALGOL will be reviewed. Considerable time will also be devoted to topics such as real-time control, principles of computer functions, study of available equipment, board use categories of equipment, etc. 2 hr. rec. 3 hr. lab.

282. ADVANCED DIGITAL COMPUTER CONCEPTS. 3 hr. PR: I.E. 180 or 281 or consent. Principles of digital computer functional components. Study of digital operating systems including structure of the various subsystem components such as monitors, input output control systems, and loaders. Advanced operating system concepts including multiprogramming, multiprocessing, teleprocessing, and time sharing will be covered. Various existing operating systems will be evaluated as well as principles in overall system design. 3 hr. rec.

283. INFORMATION RETRIEVAL. 3 hr. PR: I.E. 180 or 281 or consent. Study of the tools, elements, and theories of information storage and retrieval. Areas of study include documentation, information framework; indexing; elements of usage, organization, and equipment; parameters and implementation; theories of file organization and system design. 3 hr. rec.

284. SIMULATION BY DIGITAL METHODS. 3 hr. PR: I.E. 224 or consent and Fortran programming experience. An introduction to methods of simulation using the

digital computer. Study of the methods of generating random numbers, the Monte Carlo technique, process generators, industrial dynamics models, methods of error analysis and reduction, and digital computer simulation languages such as Simscript, Dynamo, Fordyn, and especially GPSS (General Purpose System Simulator-III). The student will be provided the opportunity to use the digital computer to simulate moderately complex production, inventory, queueing, and maintenance systems. Although the primary emphasis is more practically restricted to models of industrial operations, the techniques are immediately adaptable to simulation of any physical or information system. Simulated experiments are also considered. 3 hr. rec.

- *287. **ENGINEERING ECONOMY.** 3 hr. PR: Junior standing. Comparison of the relative economy of engineering alternatives; compound interest in relation to calculation of annual costs; present worth and prospective rates of return on investments; methods of depreciation; sunk costs, increment costs; general economy studies with emphasis on retirement and replacement of equipment; consideration of taxes, public works, and manufacturing costs as related to economic solution of engineering proposals. 3 hr. rec.
- *288. **JOB EVALUATION AND WAGE INCENTIVES.** 3 hr. PR: I.E. 140 or consent. Principles used in evaluating jobs, rates of pay, characteristics and objectives of wage incentive plans; incentive formulae and curves. 3 hr. rec.
- *290. **INDUSTRIAL STATISTICS.** 2 hr. PR: I.E. 244. Economic objectives of quality control in manufacturing through sampling methods; the Shewhart control chart for variables, attributes, and defects per unit; statistical approach to acceptance procedures. 2 hr. rec.
- 292. **PLANT LAYOUT AND DESIGN.** 3 hr. PR: I.E. 110 and 142. Problems in industrial plant design. Equipment location, space utilization, layout for operation and control, flow sheets, materials handling. Allied topics in power utilization, light, heat, and ventilation. 1 hr. rec., 6 hr. lab.
- *294. **STANDARD MANUFACTURING COSTS.** 3 hr. PR: I.E. 151. Development of standards for labor, material, and overhead expenses; uses of standards for control; analyses of variances between standard and actual costs. 3 hr. rec.
- 299. **HUMAN FACTORS ENGINEERING.** 3 hr. PR: I.E. 140, Psych. 115 or consent. An examination of human factors engineering and man-machine systems to include a study of ambient environment, human capabilities and equipment design. Application of human factors engineering in workplace design, maintainability, and task design methodology. Study of system design for man-computer interface, life support requirements, simulators and man-machine systems. 2 hr. rec., 3 hr. lab.
- 300. **ADVANCED METAL-CUTTING THEORY AND PRACTICE.** 3 hr. PR: I.E. 200. The development of metal-cutting as a science through research, cutting-fluid theory, machinability of materials, tool materials, hot machining, tool-life tests, economics of machining. 2 hr. rec., 3 hr. lab.
- 310. **ADVANCED MANUFACTURING PROCESSES.** 3 hr. PR: I.E. 100. A study of the newer and more complex manufacturing methods used in industry today. Welding and forming of titanium, magnesium, beryllium, and similar metals; assembly processes; powder metallurgy; adhesives and bonds; roll milling; electrical and chemical operations such as electro-forming and hot-dipping operations; hot forging; high energy rate forming (HERF); automated manufacturing processes including transfer mechanisms, continuous, and point-to-point numerical control; plastic tooling and fabrication methods; marking processes; and other manufacturing processes will be examined. 3 hr. rec.
- 311. **SEMINAR.** 1-6 hr. PR: Consent. Discussion of research in Industrial Engineering and special problems.
- 312. **AUTOMATION IN INDUSTRY.** 3 hr. PR: I.E. 100 or consent. The evolution, production fundamentals, and control systems of the principal fully automatic machine tools, both fixed and flexible, will be covered along with the basic philosophy, fundamentals, and methods of automation as practiced in industry today. 2 hr. rec., 3 hr. lab.

315. MANAGEMENT CONTROL. 3 hr. PR: I.E. 151 or consent. A study of effective techniques for higher management control; a study of integrated and related control data to aid in establishing a preconceived goal. 3 hr. rec.

344. ADVANCED DESIGN OF INDUSTRIAL EXPERIMENTS. 3 hr. PR: I.E. 214. A study of several of the more complex statistical methods including sequential analysis, analysis of covariance, multiple range tests, transformation of data, orthogonal polynomials, large factorial experiments, confounding, fractional replication, split-plot designs, lattice designs with one and two restrictions on treatment allocation, with special emphasis on the power, relative efficiency, and interpretation of these designs.

350. QUEUEING THEORY. 3 hr. PR: I.E. 244. Best operating conditions for systems involving waiting times. Elements of stochastic processes. Single-channel and multi-channel models. Computational methods, including Monte Carlo techniques. Applications to problems such as maintenance and inventory control. 3 hr. rec.

351. THEORY OF LINEAR PROGRAMMING. 3 hr. PR: I.E. 244 and I.E. 253 or consent. Extreme point solutions and their generation. Development of the simplex procedure. Duality problems in linear programming. Revised simplex procedure. Degeneracy procedures. Transportation problems. Selected topics related to linear programming. 3 hr. rec.

352. INTRODUCTION TO INVENTORY THEORY. 3 hr. PR: I.E. 215, 253, and 354. A study of techniques used in the optimization of inventory systems. Elements of static, deterministic inventory models, and static, stochastic inventory models. Dynamic inventory models. Selected topics related to inventory analysis. 3 hr. rec.

353. APPLIED MATHEMATICAL PROGRAMMING. 3 hr. PR: I.E. 254 or consent. Application of the assignment, transportation, and simplex algorithms to typical industrial and economic problems. The methods and computational efficiencies of the revised simplex and other algorithms are also studied and compared with the conventional methods. Computational methods of duality and the dual-simplex and primal-dual algorithms are covered. The following special topics are also included: effect of changes or addition of vectors, secondary constraints, the decomposition principle, fixed changes (intercepts), upper bound constraints, and transshipment. 3 hr. rec.

354. SPECIAL TOPICS IN SYSTEMS ANALYSIS AND OPERATIONS RESEARCH. 3-6 hr. PR: Consent. Special topics from recent developments in operations research and related fields. Special emphasis will be placed on interests of current graduate students.

355. APPLIED STOCHASTIC PROCESSES. 3 hr. PR: I.E. 215, I.E. 253, I.E. 356. Study of stochastic systems with particular emphasis on application to inventory and queueing theory. Areas of study include conditional probability, Poisson processes, counting processes, renewal processes, Markov chains with discrete and continuous parameters.

356. PROBABILITY THEORY FOR ENGINEERS. 3 hr. PR: I.E. 215. Study of probability theory and its applications to industrial systems with particular emphasis on inventory systems, queueing models, maintenance, reliability, and quality control. Areas of study include mathematical models of random phenomena, basic probability theory, mean and variance of a probability law, probability laws and their application to inventory and queueing theory, expectation of a random variable, cost and profit as functions of random variables.

361. METHODS ANALYSIS AND WORK SIMPLIFICATION. 3 hr. PR: I.E. 140, 287. An advanced study of the techniques of methods analysis, including modern means of methods research. Development of appropriate cost analyses to accompany improved operating plans. A study of the design, installation, and administration of work simplification programs, suggestion systems, and remuneration policies, and the means of intra-plant communications concerning such programs. 2 hr. rec., 3 hr. lab.

370. **THEORY OF INDUSTRIAL ENGINEERING AND ORGANIZATION.** 3 hr. PR: Graduate standing and consent. History and development of scientific management in industry with early works of Taylor, Galbreth, and Gantt, to the present time. 3 hr. rec.

371. **METHODS ANALYSIS.** 2 hr. PR: I.E. 140 or I.E. 240. An advanced study of the techniques of methods analysis as an effective means of methods improvement and cost reduction. 2 hr. rec.

372. **ADVANCED TIME STUDY.** 3 hr. PR: I.E. 140. Review of the various investigations which have been made, with special consideration given to the development of these studies into new fields. 3 hr. rec.

373. **BUDGET CONTROL.** 3 hr. PR: I.E. 294. Principles involved in the preparation of budgets by functional divisions and the application of divisional budgets as control media. 3 hr. rec.

374. **ADVANCED ENGINEERING ECONOMY.** 3 hr. PR: I.E. 287. Special emphasis on depreciation, engineering and economic aspects of selection and replacement of equipment; relationship of technical economy to income taxation and load factor and capacity to economy. 3 hr. rec.

380. **INTEGRATED DATA PROCESSING.** 3 hr. PR: I.E. 281 and consent. Advanced work in electronic data-processing systems and procedures design. Case studies of integrated data-processing systems. Course projects will include individual use of a computer in management data-processing analysis problems. 3 hr. rec.

381. **DIGITAL COMPUTER APPLICATIONS.** 1 hr. PR: Graduate standing in Engineering, Physical Science or Mathematics. Introduction to methods of digital computation and study of the programming process with emphasis on coding with an automatic programming language for scientific problems (FORTRAN). The student will have considerable opportunity to analyze engineering and scientific problems using the facilities available at the University Computer Center. 2 hr. rec., 3 hr. lab. (5-week period.)

390. **ADVANCED INDUSTRIAL STATISTICS.** 3 hr. PR: I.E. 290. Advanced study of 10 per cent-, double-, and sequential-sampling procedures, problems of application of statistical quality control methods in industries. 3 hr. rec.

397. **RESEARCH.** 1-15 hr. Investigation or original research on some special topic relating to industrial engineering.

398. **ADVANCED PROBLEMS IN HUMAN FACTORS.** 1-3 hr. PR: I.E. 299 or 399 and graduate standing. Special problems relating to one of the areas of human factors such as simulation, controls, vigilance, maintainability, etc.

399. **HUMAN FACTORS SYSTEM DESIGN.** 3 hr. PR: I.E. 299, or consent. Application of human factors engineering in workplace design, maintainability, and task design methodology. A study of system design for man-computer interface, life support requirements, simulators, and man-machine systems. Research work in lab deals with human factors system design. 3 hr. rec.

MECHANICAL ENGINEERING

Students must comply with the rules and regulations as outlined in the General Requirements for graduate work in the College of Engineering. A graduate student electing Mechanical Engineering as his major should have had the equivalent of an E.C.P.D. accredited undergraduate degree in Mechanical Engineering or be willing to remove any deficiencies prior to starting on a graduate program. In addition, a graduate student in the Department of Mechanical Engineering must comply with the departmental requirements as outlined below.

MASTER OF SCIENCE IN MECHANICAL ENGINEERING

Courses. No rigid curriculum is set up for the M.S.M.E. degree. Certain general requirements must be met, however, by all candidates for this degree. Each student, in concert with his adviser, is expected to develop a plan of study, as soon as possible,

indicating his courses and the area of his thesis interest. The plan should include at least six semester hours of advanced mathematics beyond differential equations and may also include courses in physics or chemistry in the 200 or 300 series. A minimum of twelve hours should be taken in Mechanical Engineering courses, with two-course depth in at least one major area. The remaining courses may be selected from other departmental offerings in the College of Engineering when particularly suited to the objectives of the student. In general, at least one-half of the hours listed in the plan should be at the 300-level. No 200-level course that is required in the undergraduate curriculum in Mechanical Engineering may be taken for graduate credit. Any deviation or modification of the plan shall be subject to prior approval of the adviser.

Thesis. A thesis is normally required of all candidates for the degree of Master of Science in Mechanical Engineering.

Final Examination. Each candidate for the M.S.M.E. degree shall be required to pass a final examination administered by his advisory committee. This examination may be written or oral or both and may cover material in the courses or thesis area of the student.

THE DEGREE OF DOCTOR OF PHILOSOPHY

Students intending to pursue a Ph.D. program in Mechanical Engineering should have earned a B.S. or M.S. degree in Mechanical Engineering or an equivalent curriculum. While it is possible for a student with a B.S. degree to enroll directly in the Ph.D. program, it is usually advisable for him to earn the M.S.M.E. first. An exception might be indicated for anyone planning to enter the teaching profession or on a special doctoral support program.

As with the M.S.M.E. program, the courses of study are selected to fit the individual interests and objectives of the student, with proper attention given to the rounding out of related areas of study.

The research work for the doctoral dissertation is expected to represent a significant contribution to the art or science of engineering. It may entail a fundamental investigation into a specialized area, or a broad and comprehensive study of a novel system design. In either case, a high degree of creative and original effort is required to meet the standards of acceptability.

The student must pass a final examination in defense of his dissertation administered by his research committee.

MECHANICAL ENGINEERING

204. MECHANICAL VIBRATIONS. 3 hr. PR: Math 140 and T.A.M. 104 or consent. Fundamentals of vibration theory. Free and forced vibration of one, two and multiple degree of freedom systems, transient analysis. Solution by Fourier and Laplace Transformation. Methods of Rayleigh, Holzer, and Stodola. Conservative systems and LaGrange's equation. 3 hr. rec.
205. KINEMATICS. 3 hr. PR: M.E. 112 and Math. 140, or consent. Geometry of constrained motion, kinematic synthesis and design, spacial linkages. Coupler curves, inflection circle, Euler-Savary equation, cubic of stationary curvature and finite displacement techniques. 3 hr. rec.
224. STEAM TURBINES. 3 hr. PR: M.E. 125. The theory of fluid dynamics and the thermodynamics of the modern turbines; materials, construction details and design of important elements; influences on economy of variations in cycles and operative ranges. 3 hr. rec.
225. PROBLEMS IN THERMODYNAMICS. 3 hr. PR: M.E. 125 or consent. Detailed study of thermodynamics systems with special emphasis on actual processes. The problems presented are designed to strengthen the background of the student in the application of the fundamental thermodynamic concepts. 2 hr. rec., 3 hr. lab.
231. INTRODUCTION TO GAS DYNAMICS. 3 hr. PR: M.E. 125 or M.E. 121, Math. 140. The basic fundamentals of gas dynamics, one-dimensional gas dynamics and wave motion, methods of measurement, effect of viscosity and conductivity, and concepts from gas kinetics. 3 hr. rec.

235. **HEAT TRANSFER II.** 3 hr. PR: M.E. 230. A continuation of M.E. 230, covering nonlinear extended surface; gas radiation; freezing; heat exchanger theory; recovery factor and high speed flow; and mass transfer. Also, periodic flow and application of the digital computer to problems in heat transfer. 3 hr. rec.

250. **HEATING, VENTILATING, AND AIR CONDITIONING.** 3 hr. PR: M.E. 125 or consent. Methods and systems of heating, ventilating, and air conditioning of various types of buildings, types of controls and their application. 3 hr. rec.

260. **INTRODUCTORY ENGINEERING SYSTEMS ANALYSIS.** 3 hr. PR: Senior standing. A study of analogous and mixed systems. Similitude of mechanical, electrical, and acoustic dynamic systems. Dimensional analysis and theory of model design. 3 hr. rec.

265. **ENGINEERING ACOUSTICS.** 3 hr. PR: Math. 140 and consent. Use of fundamental principles of mathematics and physics to develop the basic theories of sound. Application of these theories involving sound in closed areas, the various modes of sound transmission, noise control and psycho-acoustic criteria. 3 hr. rec.

271. **INTRODUCTION TO FEEDBACK CONTROL THEORY.** 3 hr. PR: M.E. 125 or M.E. 121 and C.E. 115 or conc: C.E. 115. Use of fundamental properties of fluids and fluid flow in the operation of power control systems. The theory and design of hydraulic and air operated control components with special emphasis on automatic circuits. 3 hr. rec.

280. **MECHANICAL PROBLEMS.** 1-6 hr. For junior, senior, and graduate students.

300. **SEMINAR.** 1-3 hr. PR: Consent. Discussion, library readings, and individual study reports in the mechanical engineering field.

303. **ADVANCED MACHINE DESIGN.** 3 hr. PR: M.E. 203. Stresses in indeterminate machine parts, experimental stress analysis. Design for high temperatures, pressures and speeds. Bearings and lubrication. Rotating discs and elastic stability and high speeds. Residual stresses and creep. 3 hr. rec.

304. **ADVANCED VIBRATIONS.** 3 hr. PR: M.E. 204 or consent. Dynamic and harmonic analysis of multiple degree of freedom and continuous linear systems. Lagrange's equations and matrix techniques. Use of analog and numerical techniques. 3 hr. rec.

305. **RANDOM VIBRATIONS.** 3 hr. PR: M.E. 204 or consent. Characterization of random motion. Response of linear time invariant systems. First and second failure problems. Fatigue under random excitation. 3 hr. rec.

320. **ADVANCED THERMODYNAMICS.** 3 hr. PR: M.E. 125. Definitions and scope of thermodynamics. First and Second laws, Maxwell's relation, Calpeyron relations, equation of state, thermodynamics of reactive systems, availability.

321. **ADVANCED THERMODYNAMICS II.** 3 hr PR: M.E. 320 or consent. Methods of statistical mechanics; concept of temperature; perfect diatomic gases and crystalline solids, Jacobian equations of thermodynamics; grand potential function; inherently irreversible processes.

325. **IRREVERSIBLE THERMODYNAMICS I.** 3 hr. PR: M.E. 320 or consent. Phenomenological treatment of the laws of dynamics and thermodynamics for irreversible processes in continuous media. The linear laws for combined irreversible phenomena including viscous dissipation, heat conduction, diffusion, chemical reactions and electric and magnetic effects, are developed taking into account Curie's principle and the Onsager relations. The principle of the minimum rate of creation of entropy is extended to establish criteria for the stability of stationary states. Tensor and variational methods are employed.

326. **IRREVERSIBLE THERMODYNAMICS II.** 3 hr. PR: M.E. 325. A continuation of M.E. 325 with emphasis on selected topics from such applications as thermoelectricity, anisotropic heat conduction, stability of fluid motion, thermal diffusion and separation, visco-chemical drag, electro chemical cells, and other coupled phenomena of physical or biological interest.

330. CONDUCTION HEAT TRANSFER. 3 hr. PR: M.E. 230 or consent. Analytical, numerical, graphical, and analog solutions of steady and non-steady heat conduction problems in isotropic and anisotropic solids. Representative topics include: thermal properties, extended surfaces, thermal stress, interphase conduction with moving interface, localized and distributed sources.

331. CONVECTION HEAT TRANSFER. 3 hr. PR: M.E. 230 or consent. Rigorous study of the fundamental mechanisms of the heat convection processes in both laminar and turbulent flows. Analytical, numerical, and analogical solution as applied to convective systems. Selected topics for discussion as related to student interest and study of current research publications.

332. RADIATION HEAT TRANSFER. 3 hr. PR: M.E. 230. Classical derivation of black body radiation laws; grey body and non-grey analysis; radiant properties of materials, radiant transport analysis, specular-diffuse networks, gas radiation, thermal radiation measurements: analytical, numerical solutions, and study of selected current publications.

351. ADVANCED INTERNAL COMBUSTION ENGINES. 3 hr. PR: M.E. 229 or consent. Combustion in spark ignition engines; compression ignition engines; detonation; fuel-air ratios; heat losses; lubrication; efficiencies; two-stroke engines; four-stroke engines; performance, exhaust turbines; gas turbines. 3 hr. rec.

352. TURBOMACHINERY. 3 hr. PR: M.E. 121 or M.E. 125. A study of flow problems encountered in the design of water, gas, and steam turbines, centrifugal and axial flow pumps and compressors, design parameters.

354. ADVANCED REFRIGERATION. 3 hr. PR: M.E. 250. Thermodynamics of vapor cycles, refrigerants, fluid flow, heat transfer, psychometrics, types of refrigeration and equipment required, application of refrigeration in industry, food preservation. 3 hr. rec.

360. ENGINEERING SIMILITUDES. 3 hr. PR: Consent. Development of the dimensional analysis concepts and techniques and their application in model design. Rational approach to the design of distorted models. Study of analogies from a stand-point of model-prototype relations. 3 hr. rec.

397. RESEARCH. 1-15 hr. Investigation or original research on some topic relating to mechanical engineering.

THEORETICAL AND APPLIED MECHANICS

MASTER OF SCIENCE IN THEORETICAL AND APPLIED MECHANICS

Students must comply with rules and regulations as outlined in the Guide to the Graduate Program in Engineering.

Courses. At least 30 semester hours are required for the degree of Master of Science in Theoretical and Applied Mechanics. At least 12 of these hours, exclusive of thesis, must be in the Department of Theoretical and Applied Mechanics. As many courses as are possible should be in the 300 series. A minor in one of the other branches of engineering, physics, or mathematics is recommended.

Thesis. A thesis is usually required for the degree of Master of Science in Theoretical and Applied Mechanics, and is ordinarily for 6 hours credit. The thesis must conform to the general requirements of the Graduate School and to the additional requirements of the Department.

Thesis Supervisor. Each student will be assigned a thesis supervisor who will serve as chairman of his thesis committee.

Final Examination. On completion of his thesis, the candidate for the degree of Master of Science in Theoretical and Applied Mechanics will be given an oral examination by his thesis committee. Additional examiners may be called in for this examination.

THE DEGREE OF DOCTOR OF PHILOSOPHY

Graduate students electing Theoretical and Applied Mechanics as their major must have had the equivalent of the undergraduate courses in mechanics required for a bachelor's degree in any of the curricula in the College of Engineering.

A graduate student who has received a Master's degree from a school which has an undergraduate curriculum in the area of his Master's degree accredited by E.C.P.D. may pursue a Ph.D. degree in Theoretical and Applied Mechanics if he meets the other requirements of the Department.

Candidates for the Doctor of Philosophy degree, regardless of their specific major, must attain a proficiency in each of the following areas: (1) mechanics of solids, (2) mechanics of fluids, (3) dynamics, (4) experimental mechanics, and (5) applied mathematics.

'THEORETICAL AND APPLIED MECHANICS

200. ADVANCED MECHANICS OF MATERIALS I. 3 hr. PR: T.A.M. 103 or consent. Energy methods; localized stresses; curved flexural members; torsion of non-circular sections; thick-walled cylinders and rotating disks; contact stresses. 3 hr. rec. Offered each fall.
201. THEORY AND APPLICATION OF OSCILLATORY PHENOMENA. 3 hr. PR: T.A.M. 104. Study of oscillations or vibrations in acoustical, electrical, hydraulic and mechanical systems. 3 hr. rec. Offered spring of even years.
202. ADVANCED LABORATORY. 3 hr. PR: Consent. Applied engineering measurements and instrumentation dealing with mechanical phenomena as force, displacement, pressure torque, velocity, and acceleration. Introduces students to various transducer, signal conditioning, and readout equipment. Time allowed for term project of specific student interest. Offered spring of even years.
203. EXPERIMENTAL STRESS ANALYSIS. 3 hr. PR: T.A.M. 103, 104. Introduction to some of the more common experimental methods of analyzing stress distributions. Photoelasticity, brittle lacquers, birefringent coatings, strain gage techniques and instrumentation, as applied to problems involving static, dynamic and residual stress distributions. 2 hr. rec., 3 hr. lab. Offered each fall.
250. INTERMEDIATE DYNAMICS. 3 hr. PR: Math. 253, T.A.M. 104. Brief review of vectorial mechanics with emphasis on the dynamics of systems of particles and applications such as the motion of a rocket and orbital mechanics. Derivation of Lagrange's Equations from the principle of virtual work and D'Alembert's Principle and the application of these equations to engineering problems involving conservative and nonconservative systems. 3 hr. rec. Offered each fall.
280. SPECIAL PROBLEMS IN MECHANICS. 1-3 hr. PR: T.A.M. 103 and consent. For junior, senior, and graduate students. Offered every semester and summer.
302. ANALYTICAL METHODS IN ENGINEERING I. 3 hr. PR: Math. 257 or consent. A course designed to provide training in the applications of mathematical analysis to engineering problems. Course content to include: index notation; determinant, matrices, and quadratic forms; linear vector spaces; linear transformations, eigen-value problems; ordinary differential equations in the complex plane, existence and uniqueness theories, series solution for regular and irregular singularities, Legendre and Bessel equation, integral solutions. 3 hr. rec. Offered each fall.
303. ANALYTICAL METHODS IN ENGINEERING II. 3 hr. PR: T.A.M. 302 or consent. Continuation of T.A.M. 302. Course content to include: partial differential equations, method of characteristics, initial and boundary conditions; Dirichlet, Neumann, and Cauchy problems, calculus of variations, stationary values of functions and functionals, Euler equations and boundary conditions, Lagrange multipliers, second variation for maximum problems, applications such as Hamilton's principle, linear integral equations, equations of the first and second kind, solution by successive substitution and approximation, eigen-values and eigen-functions, Fredholm theory, applications. 3 hr. rec. Offered each spring.
310. ADVANCED MECHANICS OF MATERIALS II. 3 hr. PR: Consent. Membrane stresses in shells; bending of flat plates; two-dimensional elasticity; beams on elastic supports. 3 hr. rec. Offered each spring.

312. INELASTIC BEHAVIOR OF ENGINEERING MATERIALS. 3 hr. PR: T.A.M. 200. Rheological aspects of inelastic behavior, inelastic load-stress relationship for members subjected to axial, bending, torsion and buckling loads. Analytical stress-strain relationships and material modeling. Combined loading, interaction curves and their use. Statically indeterminate members loaded inelastically; inelastic buckling theory. 3 hr. rec. Offered fall of even years.

314. THEORY OF BUCKLING. 3 hr. PR: Consent. Fundamental theorems for the investigation of stability of mechanical systems. Application to discrete systems and development of stability equations for elastic bodies. 3 hr. rec. Offered spring of even years.

316. ENERGY METHODS IN APPLIED MECHANICS. 3 hr. PR: Consent. Introduction to variational principle of mechanics and applications to engineering problems; principle of virtual displacements, principle of minimum potential energy, principle of complementary energy. Castiglano's theorem, Hamilton's principle. Applications of energy principles to stress analysis and problems of dynamics. 3 hr. rec. Offered each fall.

318. CONTINUUM MECHANICS. 3 hr. PR: Undergraduate mechanics and Math. 253. A course designed to emphasize the basic laws of physical behavior of continuous media. Course content to include: analysis of stress; equations of motion and boundary conditions; kinematic analysis; rates of strain, dilatation and rotation; bulk time, rates of change; constitutive equations with special attention to elastic bodies and ideal fluids; energy equations and the first law of thermodynamics. 3 hr. rec. Offered each fall.

319. NON-LINEAR CONTINUUM MECHANICS. 3 hr. PR: T.A.M. 318 or consent. Study of the basic laws of continuous media in the language of generalized tensors. Emphasis on the structure of the constitutive equations for various classes of media with particular attention to elastic, hypoelastic, plastic and viscoelastic media. 3 hr. rec. Offered spring of even years.

320. THEORY OF ELASTICITY I. 3 hr. PR: Math. 253 or consent. A basic solid mechanics course to include: Cartesian tensors; equations of classical elasticity, energy, minimum, and uniqueness theorems for the first and second boundary value problems; St-Venant principle; extension, torsion, and bending problems. 3 hr. rec. Offered each fall.

321. THEORY OF ELASTICITY II. 3 hr. PR: T.A.M. 320. Continuation of T.A.M. 320 to include: equations of classical elasticity in generalized coordinates; complex variables and potentials; plane stress and strain; various special problems. 3 hr. rec. Offered each spring.

324. THEORY OF THIN SHELLS. 3 hr. PR: Consent. Theoretical basis for analysis of shell-type structures. Material includes differential geometry of surfaces, current shell theories, and stability criteria. 3 hr. rec. Offered spring of odd years.

330. INSTRUMENTATION IN ENGINEERING I. 3 hr. PR: T.A.M. 104 or equiv. Theory of measuring instruments, with emphasis on dynamic, as opposed to static or slowly changing, measurements of force, pressure, displacement, vibration, temperature, etc. Also, selection of instruments for specific purposes. 2 hr. rec., 3 hr. lab. Offered each spring.

331. INSTRUMENTATION IN ENGINEERING II. 3 hr. PR: T.A.M. 330. Continuation of T.A.M. 330 with emphasis on transducers for static and dynamic measurement, and their use in practical measuring systems. 3 hr. rec. Offered fall of odd years.

340. PHOTOELASTICITY. 3 hr. PR: T.A.M. 200, 203. Theory of optics, birefringence, stress-optic law, polariscope, compensation. Techniques of model making, photography, polariscope use. Photoelastic coating methods and use of various reflective polariscopes. Data interpretation by various methods including principal stress separation by shear difference and graphical integration. 2 hr. rec., 3 hr. lab. Offered fall of odd years.

342. BIOMECHANICS SEMINAR I. 3 hr. PR: Consent. Introduction to the principles and terminology of biomechanics, guest lecturers in anatomy, physiology, and biology; critical review of research papers of current interest and a consideration of the sources and forms of the literature. 3 hr. rec. Offered each fall.

343. BIOMECHANICS SEMINAR II. 3 hr. PR: T.A.M. 324 or consent. Continuation of T.A.M. 342 with emphasis on the medical applications of engineering and the techniques of mathematical modeling to biological systems. 3 hr. rec. Offered each spring.

350. ADVANCED DYNAMICS I. 3 hr. PR: T.A.M. 250. Continuation of T.A.M. 250. Mechanics of rigid bodies; theory of moments of inertia, angular momentum and kinetic energy, Poinsot's interpretation of torque-free motion, Euler's angles, Euler's dynamical equations, pitch, roll, yaw, spinning top, gyroscopes, etc. 3 hr. rec. Offered every spring.

351. ADVANCED DYNAMICS II. 3 hr. PR: Consent. Dynamics of continuous solids. Wave motion; study of string motion in detail in order to introduce methods for attacking more general problems such as vibration of beams, membranes and plates. Stress propagation in unlimited solids; dilatational, distortional, and surface waves. 3 hr. rec. Offered fall of odd years.

360. FLOW OF NON-VISCOS FLUIDS. 3 hr. PR: Consent. Introduction to potential theory, conservative force fields, continuity equation, energy equation, equation of state, ideal fluid. Derivation of Bernoulli equation. Complex variable with applications in potential flow. 3 hr. rec. Offered each fall.

361. FLOW OF VISCOUS FLUIDS. 3 hr. PR: Consent. Derivation of the Navier-Stokes equations, continuity equations, equation of state, energy equation, energy dissipation, boundary layer phenomena. Simultaneous mass and heat transfer at the fluid boundaries. 3 hr. rec. Offered in spring of odd years.

380. ADVANCED INDEPENDENT STUDY. 1-3 hr. PR: Consent. Individual investigation, either analytical or experimental, in one or more phases of advanced mechanics. Offered each semester and summer.

397. RESEARCH. 1-15 hr. Advanced research or special investigations on some topic related to mechanics. Offered each semester and summer.

MINES

The School of Mines offers graduate curricula leading to the Master of Science degree in two fields—mining engineering and petroleum engineering. A student desiring to take courses for graduate credit in the School of Mines must first comply with the appropriate regulations of the Graduate School.

After admission to the Graduate School, a student desiring to become a candidate for a graduate degree must apply for admission to the School of Mines in the major field of his choice.

An applicant with a baccalaureate degree or its equivalent in the major field corresponding to the graduate study desired, from a department accredited by the Engineers' Council for Professional Development, will be admitted on the same basis as graduates of West Virginia University. Lacking these qualifications, an applicant must first fulfill the School of Mines' requirements in the field in which he is seeking an advanced degree.

Approval for candidacy for a graduate degree by faculty action is required to establish eligibility for a degree. A graduate student may request approval by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0 (B), based on all graduate courses in residence for which final grades have been recorded.

Academic Standards. No credits are acceptable toward an advanced degree which are reported with a grade lower than "C." To qualify for an advanced degree, a graduate student must have a grade-point average of at least 3.0 based on all courses completed in residence for graduate credit. Each candidate for a degree must select a major subject and submit a thesis showing marked attainment in that field.

ENGINEERING OF MINES

200. ELEMENTS OF MINERAL CONSERVATION. I. 3 hr. PR: Open to any student in the University with junior standing. A study of the future demands for mineral resources including coal, water, oil, gas, ores, and industrial minerals and the causes of mineral loss in production and utilization and how to avoid or minimize them.

201. FIRE CONTROL ENGINEERING. 3 or 4 hr. PR: Senior standing in an engineering curriculum or consent. The aspects involved in the control from fire, explosion and other related hazards. Protective considerations in building design and construction. Fire and explosive protection organization including fire detection and control. Lectures 3 and/or 3 hr. lab.

207. INTRODUCTORY SEISMOLOGY. I. 1 hr. PR: Physics 102. Earthquakes and the causes and area distribution; theory of elastic waves; the principles of seismograph construction, adjustment, and operation, interpretation and calculation of seismograms with exercises provided by records of the University seismograph station. 1 hr. rec.

209. MINERAL PREPARATION. I, II. 3 hr. PR: T.A.M. 104 or consent. Principles of preparation, beneficiation, and concentration of metallic and non-metallic ores for further processing or utilization. 2 hr. rec., 3 hr. lab.

212. ADVANCED MINING. II. 3 hr. PR: E.M. 108, E.E. 105. Engineering principles, methods and equipment applied to mine transportation, hoisting, and drainage. 3 hr. rec.

213. MINE VENTILATION. I. 3 hr. PR: E.M. 108, T.A.M. 104, and C.E. 115. Principles, purposes, methods and equipment pertaining to the ventilation of mines. 2 hr. rec., 3 hr. lab.

215. INDUSTRIAL SAFETY ENGINEERING. I, II. 2 hr. PR: Junior standing or consent. Analysis of problems of industrial safety and accident prevention, laws pertaining to industrial safety and health, compensation plans and laws, and industrial property protection. 2 hr. rec.

217. COAL PREPARATION. I, II. 3 hr. PR: E.M. 212, C.E. 115, E.M. 209, and E.M. 210. Formation of coal, rank classification of coal, coal petrography, principles of preparing and beneficiating coal for market with laboratory devoted to sampling, screen analysis, float and sink separation, and use of various types of coal cleaning equipment. 2 hr. rec., 3 hr. lab.

218. ADVANCED MINERAL PREPARATION. I, II. 3 hr. PR: E.M. 108, E.M. 209. The theory and practice of concentration ores, and industrial minerals with special consideration to the more recent advances in the beneficiation of both ores and coal. 2 hr. rec., 3 hr. lab.

219. ADVANCED MINING METHODS FOR VEIN DEPOSITS. I, II. 3 hr. PR: E.M. 108, T.A.M. 104. Methods and systems of mining other than flat seams. Emphasis placed on selection of methods in relation to cohesive strength of ore bodies and their enclosing wall rocks. Mining of anthracite is included. 3 hr. rec.

220. MINE DESIGN. I, II. 3 hr. PR: E.M. 212, E.M. 241. A comprehensive design problem involving underground mining developments or design of surface plant or both, as elected by the student in consultation with the instructor. A complete report on the problem is required including drawings, specifications, and cost analysis. 9 hr. lab.

222. MINE EQUIPMENT AND MACHINERY. II. 3 hr. PR: E.E. 205, E.M. 212. Selection, installation, operation, and maintenance of mining equipment. 3 hr. rec.

223. MINE MANAGEMENT. II. 3 hr. PR: Math. 140, E.M. 212 and senior standing. Economic, governmental, social, and labor aspects of mining as related to the management of a mining enterprise. 3 hr. rec.

224. MINING ENGINEERING PROBLEMS. I, II. 1-6 hr. PR: Senior or graduate standing. Investigation and detailed report on a special problem in mining engineering

related to coal mining or mineral mining. Supervision and guidance by a member of the graduate faculty.

228. **MINE EQUIPMENT AND MACHINERY CONTROLS. I.** 3 hr. PR: E.M. 222 or consent. Principles, application and use of electric and hydraulic devices and circuits for protection and control of mine machinery and equipment. 3 hr. rec.

229. **ADVANCED MINING EQUIPMENT APPLICATIONS. II.** 3 hr. PR: E.M. 228. Structural, mechanical, hydraulic and electrical characteristics of the more common items of mining equipment. Controls, electrical and hydraulic circuits, and mechanical transmissions with associated problems. Laboratory design of a control system for a mining machine. 2 hr. rec., 3 hr. lab.

230. **ELEMENTS OF GEOPHYSICAL PROSPECTING. I.** 3 or 4 hr. PR: Geol. 1, Physics 11. Principles, calculations and application of methods for locating subsurface oil, gas, and mineral deposits.

241. **MECHANICS OF GROUND CONTROL IN MINES. I.** 3 hr. PR: T.A.M. 102, Math. 240, E.M. 108 or consent. Structure of the earth's crust, bedding planes, joints, heterogeneity, mechanical properties of rocks, stress-time-deformation relationships in rocks, theoretical stress distribution about mine openings, practical effects, factors in mine pillar design, pillar bursts, creeps and squeezes, mining subsidence. 2 hr. rec., 3 hr. lab.

301, 302. **ADVANCED MINE DESIGN. I, II.** Credit arranged. Advanced detail design and layout of coal mine plant, particularly incorporating new ideas of machines and mining methods.

351. **COAL MINING. S.** 3 hr. PR: Chemistry, 10 hr.; Physics, 8 hr.; and accompanied or preceded by general geology. Especially for students who are planning to teach mining subjects in high school. Not open to students taking E.M. 108 or 212. Hours arranged.

395, 396. **GRADUATE SEMINAR IN COAL MINE OPERATION AND ADMINISTRATION. I, II.** 3-6 hr. PR: B.S. degree and consent of Committee. Group discussion and analysis of problems related to the production, preparation, marketing, and utilization of coal with special assignments and emphasis in accordance with personal background and field of interest of the individual student.

397. **RESEARCH. I, II.** Credit arranged. Individual problem in some phase of mining. Carefully prepared report required.

PETROLEUM ENGINEERING

206. **NATURAL GAS ENGINEERING. I.** 3 hr. PR: Pet.E. 106, C.E. 115. Principles of natural gas production, transmission, distribution, processing, regulation, measurement, storage and analysis with a laboratory devoted to the principles of the equipment utilized in the above named operations. 2 hr. rec., 3 hr. lab.

216. **PETROLEUM ENGINEERING DESIGN. II.** 3 hr. PR: Pet.E. 232, Material Engr. 250. A comprehensive problem in design involving systems in oil and gas production, field processing, transportation and storage. Three 3-hr. labs.

224. **PETROLEUM ENGINEERING PROBLEMS. I, II.** 1-6 hr. PR: Senior or graduate standing. Investigation and detailed report on a special problem in petroleum or natural gas engineering. Supervised by a member of the graduate faculty.

232. **PETROLEUM RESERVOIR ENGINEERING. I.** 5-6 hr. PR: Pet.E. 236. Concepts of application of properties of rocks and rock-fluids systems which are fundamental to engineering analysis of petroleum reservoirs, mechanics of fluid flow in porous media, production by depletion drive, by frontal displacement, by water drive, and by segregation drive. 5 hr. rec., 3 hr. lab.

235. **FUNDAMENTALS OF WELL LOGGING. II.** 3 hr. PR: Math. 140, Pet.E. 106, or consent. Principles of the various well logging methods and related calculations with exercises in interpretation of data from actual well logs. 2 hr. rec., 3 hr. lab.

236. **MECHANICS OF HYDROCARBON FLUIDS.** I. 3 hr. PR: Physics 102, C.E. 115, Pet.E. 106, Chem. 163. The qualitative and quantitative phase behavior of single and multicomponent hydrocarbon systems with emphasis on application to petroleum production engineering and petroleum reservoir engineering. 2 hr. rec., 3 hr. lab.

237. **COMPOSITION AND PROPERTIES OF OIL WELL DRILLING FLUIDS.** II. 2 hr. PR: Pet.E. 106, Chem. 163 and C.E. 115. Principles of drilling fluid control including a laboratory for pilot testing, mud design procedures and measurement of composition and properties. 1 hr. rec., 3 hr. lab.

240. **SECONDARY RECOVERY OF OIL BY WATER FLOODING.** I. 3 hr. PR: Pet.E. 232 or consent. Theory of immiscible fluid displacement mechanism, evaluation and economics of water flood projects, and oil field flooding techniques. 3 hr. rec.

241. **PETROLEUM MANAGEMENT ENGINEERING.** II. 4 hr. PR: Pet.E. 106, Econ. 52, Math. 117 or consent. Petroleum property valuation, investment decision making, and elements of law as they pertain to petroleum, sales, transportation, and financing. 3 hr. rec., 3 hr. lab.

242. **WELL STIMULATION: FRACTURING.** I. 3 hr. PR: Pet.E. 106, 241. Theory of hydraulic fracturing, fracturing tools, fracturing fluids, fracturing orientation; propping agents and general design treatment for optimum profitability.

301. **ADVANCED PETROLEUM AND NATURAL GAS ENGINEERING DESIGN.** I, II. Credit arranged. Advanced detail design problems in some phase of petroleum and natural gas exploration, production, and transportation, particularly incorporating new ideas, machines and methods.

302. **FLUID FLOW IN POROUS MEDIA.** I. 3 hr. PR: Pet.E. 232 and Math. 140 or consent. Intensive study of theoretical and practical aspects of the physical principles of hydrodynamics in porous media. 3 hr. rec.

397. **RESEARCH.** I, II. Credit arranged. An individual research problem in some phase of petroleum and natural gas exploration, production, and transportation. A carefully prepared report is required.

EXTENSION EDUCATION

The Master of Science degree in Extension Education is an interdisciplinary program involving study in several departments and colleges of the University. The degree is designed primarily for professional workers engaged in developing and conducting field programs in adult or community education. The flexible program enables the student, through counseling with his graduate committee, to develop a plan of study designed to meet his particular requirements.

REQUIREMENTS FOR ADMISSION

The candidate must fulfill the general requirements of the Graduate School for admission. Prerequisite courses for the work the student expects to pursue may be required. Course work needed by the student to meet prerequisites, or to correct deficiencies in undergraduate preparation, will not be accepted for credit in meeting the requirements for the degree. The satisfactory completion of at least two years of professional experience is desirable.

REQUIREMENTS FOR THE DEGREE

In addition to meeting the general requirements of the Graduate School with respect to candidacy, residency, extension, scholarship, and the like, the candidate must complete 36 credit hours of approved course work. Though a thesis is not required, a student who wishes to substitute six hours of course work for a thesis must prepare during his graduate studies a paper showing familiarity with research methodology. The candidate must earn a grade-point average of no less than 2.5 in all courses completed for graduate credit.

This program is administered by the Training Coordinator of Extension Services, with concurrence of the Dean of Extension Services and the Provost. The Training Coordinator, as adviser for this program, assists the candidate in selecting a graduate committee of at least three faculty members. In cooperation with the graduate committee, he counsels candidates to assist them in arranging integrated and individualized programs suited to their needs.

The curriculum consists of 18 hours of specified core courses in the social and applied behavioral sciences which are drawn from among courses now existent or to be developed in several colleges or schools. In addition, the student will select 12 to 18 hours of approved courses in a second subject-matter area from economics, education, human resources, psychology, sociology and such other fields that seem congruent with this degree.

An effective core for this degree may consist of the following courses:

- Child Development and Family Relations 224—Family and Individual in the Community. 3 hr.
- Educ. 351—Principles of Communications and New Educational Media. 3 hr.
- Psychol. 252—Group Dynamics. 3 hr.
- Sociol. 202—Introduction to Social Research. 3 hr.
- Social. 220—Social Change. I. 3 hr.
- Speech 221—Persuasion. 3 hr.

Possible alternatives, when the above courses are not offered:

- Agr. Ed. 320—Special Topics. I, II, S. 1-4 hr.
- CDFR 264—Family Development. I, II. 3 hr.
- Econ. 231—Economic Development. I or II. 3 hr.
- Educ. 331—Philosophy of Education. I, II, S. 3 hr.
- Educ. 348—Human Development and Behavior. I, II, S. 3 hr.
- Sociol. 208—The Community. II. 3 hr.
- Speech 223—Advanced Group Discussion. II. 3 hr.

Other suggested courses for appropriate disciplines include:

- Agr. Educ. 239—Program Building in Cooperative Extension. II. 3 hr.
- Econ. 205—Current Economic Problems. S. 3 hr.
- Educ. 271—Educational Measurement. I, II, S. 3 hr.
- Educ. 301—Introduction to Educational Research. I, II, S. 3 hr.
- Educ. 385—Historical and Sociological Foundations of American Education. I, II, S. 3 hr.
- English 222—Modern American Biography. I. 3 hr.
- English 239—Southern Writers. II. 3 hr.
- English 393, 394—American Literature, 1870-. I, II. 3 hr. per sem.
- Geography 216—Urban Geography. II. 3 hr.
- HEEd. 219—Adult Education in Homemaking. I. 3 hr.
- Hist. 269—Recent American History, 1933 to the Present. 3 hr.
- Hist. 291—Intellectual and Social History of the United States since 1876. 3 hr.
- Journ. 212—Public Relations. I, II, S. 3 hr.
- Management 216—Personnel Management. I, II. 3 hr.
- Management 301—Administrative Practices. I. 3 hr.
- Pol. Sci. 221—West Virginia Government and Administration. I, II. 3 hr.
- Pol. Sci. 226—Problems of State and Local Government. I. 3 hr.
- Pol. Sci. 232—Public Opinion and Propaganda. II. 3 hr.
- Pol. Sci. 233—Current Political Issues. I. 3 hr.
- Pol. Sci. 245—Public Administration and Policy Development. I. 3 hr.
- Pol. Sci. 324—Seminar in State and Local Government. I. 3 hr.
- Psychol. 243—Child Behavior. I. 3 hr.
- Psychol. 251—Advanced Social Psychology. I. 3 hr.
- Psychol. 253—Attitudes and Propaganda. II. 3 hr.
- Psychol. 264—Psychology of Adjustment. I, II. 3 hr.
- Soc. Work 305—Introduction to Social Group Work. II. 3 hr.
- Sociol. 205—Urban Sociology. II. 3 hr.
- Sociol. 224—Social Stratification. I. 3 hr.
- Sociol. 229—Population and Migrations. I. 3 hr.
- Sociol. 231—Race Relations. I. 3 hr.
- Sociol. 244—Culture and Personality. I. 3 hr.
- Sociol. 393—Seminar in Sociological Research. I, II. 3 hr.
- Stat. 211—Statistical Method. I, II. 3 hr.

HUMAN RESOURCES AND EDUCATION

The College of Human Resources and Education includes the Divisions of Clinical Studies, Education, Family Resources, and Social Work, and the Human Resources Research Institute. Established in 1965, the College brings together several disciplines and professions devoted to the study and maximum development of human talent and resources, whether in the context of the school, the family or the community. Programs of instruction, research, and extended service are carried out in each of the divisions of the College and in close cooperation with the related departments and divisions in other sectors of the University.

REQUIREMENTS FOR ADMISSION

It is the responsibility of all applicants to apply for admission to the Graduate School through the Office of Admissions. All candidates for graduate degrees must conform to the general regulations of the Graduate School. Such general regulations and the steps to be followed in the admissions process are covered in Part II of this bulletin. Certain details in regard to admission to specific graduate programs of the College are provided on following pages. Additional information may be obtained by writing to the director of the division in which the graduate program is offered or by writing to the Dean of the College.

CURRICULUM

The curriculum and degree requirements of the various master's degree programs of the College are shown in each of the respective divisional sections. It is the responsibility of the student to take steps to insure that he is properly informed in regard to the requirements of the degree toward which he aspires and/or the certification standards to which he may wish to conform. Members of the faculty in general, and the student's adviser in particular, will offer counsel to the student on these matters on request.

THE DEGREE OF DOCTOR OF EDUCATION

The Doctor of Education degree is offered with concentration in the Division of Education (curriculum and instruction and educational administration) and the Division of Clinical Studies (including counseling and guidance, reading, speech pathology and audiology, and special education). The Doctor of Education degree is also offered in cooperation with various other schools and colleges of the University.

ADMISSION

Individuals who wish to pursue a program leading to the Doctor of Education degree must be admitted to the Graduate School. All applicants for admission to the doctoral program in the College of Human Resources and Education must submit scores on the Aptitude Test of the Graduate Record Examination and otherwise comply with each of the General Regulations of the Graduate School outlined in Part II and Part III of this bulletin. Acceptance for study toward the doctoral degree in a specific area of concentration will be based on prior academic achievement including a cumulative grade-point average of 3.0 or above and a satisfactory score on the general aptitude test of the Graduate Record Examination or other appropriate measure of academic aptitude and an interview by the Doctoral Admissions Committee during the Preliminary Examination. Students having a cumulative grade-point average of less than 3.0 but having a satisfactory score on the Graduate Record Examination or other appropriate measure of academic aptitude may be admitted provisionally; final acceptance will be contingent upon the results of the Preliminary Examination. Students who meet the standards for admission set forth by the various programs will be assigned a temporary adviser by the Dean of the College of Human Resources and Education.

PRELIMINARY EXAMINATION

The student must make application through his temporary adviser to the chairman of Graduate Affairs to take the Preliminary Examination. Usually, the examination is taken after tentative admission to the program and completion of six to twelve hours of doctoral work at West Virginia University. A maximum of eighteen (18) hours credit of doctoral work completed at West Virginia University prior to the preliminary examination may be counted toward the degree.

The purposes of the preliminary examination are to discuss with the student his proposed area of doctoral study, and to make appropriate recommendations to the Dean of the College concerning his acceptance into an area of concentration and acceptability of prior work to meet program requirements.

The composition of the preliminary examining committee shall include, at least, the chairman of graduate affairs, the coordinator of the major program, the coordinator(s) of minor, program(s), and the student's temporary adviser. Prior academic achievement, professional experiences, test results, and other evidences of competence in areas essential for successful completion of the Doctor of Education Degree will be taken into consideration.

DOCTORAL COMMITTEE

Having received an affirmative recommendation from the preliminary examination committee to continue doctoral work, a permanent adviser to serve as chairman of the student's doctoral committee will be selected by the Dean of the College, the director of the appropriate division, and the coordinator of the major program. At least four additional committee members will be selected by the permanent adviser and student. At least one member of the doctoral committee must come from a supporting discipline outside the College of Human Resources and Education and no more than three from any single division within the College.

CURRICULUM

The final determination of the program of course work and research is the responsibility of the student's doctoral committee. The Doctor of Education degree is not awarded on the basis of the completion of any set number of credits but is awarded on the basis of demonstrated academic achievement and scholarly competence. The minimum course work shall be 70 semester hours of graduate work, excluding dissertation credit but including credits of relevant graduate work completed at the master's degree level. A minimum of 24 of the 70 semester hours shall be in the area of major concentration and a minimum of 24 of the 70 semester hours from a minor area of concentration in a supporting or related discipline. At least one-half of the semester hours taken within the College and at least one-third of the hours taken outside the College shall be courses at the doctoral level.

Candidates having previously earned a graduate degree from West Virginia University will be required to earn credit in residence at another graduate institution offering the doctorate in the student's major field. The student's doctoral committee shall approve the institution and the course work. In every case, a minimum of two semesters in residence at West Virginia University as a full-time doctoral student will be required. Requirements for the Doctor of Education degree must be completed within seven years after successful completion of the preliminary examination.

ADMISSION TO CANDIDACY EXAMINATION

The purposes of the admission to candidacy examination are to assess the quality of the student's academic achievement, to review the student's program of course work, to approve a proposed outline of dissertation research, and to admit the student to formal candidacy for the degree.

The examination may be taken after at least two-thirds of the student's program of course work has been completed but prior to the dissertation phase of the program. The admission to candidacy examination consists of two parts: (a) a written examination, and (b) an oral examination. The candidate must pass the written examination prior to taking the oral portion. The written examination will include a common "foundations" section (history and philosophy of education, research design and statistics, social and psychological foundations) and specifically prepared written examinations in the major area of concentration and in the area of con-

centration in the supporting discipline. The written examination may be repeated one time and, upon consent of the Dean, director of the appropriate division, and the coordinator of major program, may be repeated a second and third time. At least six months must elapse between repeated examinations.

The oral portion of the admission to candidacy examination will be administered by the student's doctoral committee at the call of and under the direction of the committee chairman after successful completion of written portion of examination. The oral portion of the examination at which time the student must present and defend the prospectus for his doctoral dissertation, may be repeated one time and on recommendation of the doctoral committee, may be repeated a second time. At least six months must elapse between repeated examinations. On successful completion of the admission to candidacy examination, the student will be admitted to formal candidacy for the doctoral degree.

DISSERTATION

The candidate must submit and justify an outline or a prospectus for his doctoral dissertation at the oral portion of the admission to candidacy examination. The doctoral committee must review and *approve*, *approve with change*, or *reject* this outline or prospectus. The student shall consult with all members of the doctoral committee and with other appropriate members of the University faculty during the dissertation phase of his program.

FINAL ORAL EXAMINATION

The student will be admitted to a final oral examination upon completion of his dissertation and after he has fulfilled all other requirements set by his committee. This examination will be conducted by his doctoral committee and will be open to all members of the University faculty. The candidate will not be recommended for the doctoral degree if he receives more than one unfavorable vote from his doctoral committee.

CERTIFICATE OF ADVANCED STUDY

This program is designed to prepare school and related personnel who wish professional training beyond the Master's degree. Candidates for this Certificate may choose from among the following areas of study for their area(s) of concentration: (a) Administration and Supervision; (b) Curriculum and Instruction; (c) Counseling and Guidance, Reading, and Special Education; and (d) Physical Education. Persons interested in this certificate should consult with the director of the appropriate division or the Dean of the College of Human Resources and Education.

PREREQUISITES FOR ADMISSION TO THE PROGRAM

1. General requirements for admission to the Graduate School of West Virginia University.
2. A Master's Degree with a grade-point average of 3.0 or higher.
3. A minimum of three years of teaching or closely related educational experience.

REQUIREMENTS FOR ADMISSION TO CANDIDACY

1. Evidence through examination, personal letter, and personal interview of general proficiency, acceptable standards of oral written communication, and good health.
2. Satisfactory completion *in residence* at West Virginia University of at least six semester hours of approved course work beyond the conferring of the Master's degree.
3. Students must submit scores on the General Aptitude Test of the Graduate Record Examination.

REQUIREMENTS FOR COMPLETION

The Program. An approved program consisting of a minimum of 30 semester hours earned above the Master's degree of which 24 semester hours will be course

work in the College of Human Resources and Education or in closely related fields and 6 hours of research.

At least 24 semester hours of the work credited for this Certificate must be done in residence at West Virginia University. This requirement includes the 6 hours of research which may be conducted apart from the physical limits of the University but must be done under the direction and supervision of the chairman of the student's graduate committee. A maximum of 6 semester hours earned in residence at another approved graduate institution or in West Virginia University Extension may, if approved by the student's adviser, be allowed toward credit for the Certificate.

Final Examination(s). Upon completion of all requirements including the research report, the candidate will be admitted to a final oral examination by his graduate committee.

Time Limitation. All requirements must be completed within seven calendar years immediately preceding the awarding of the Certificate.

Human Resources Research Institute

The Institute is the major research facility of the College of Human Resources and Education. It does not offer a program of studies leading to a degree but provides research support, research consultation, and opportunities for participation in multidisciplinary or programmatic research projects for faculty and graduate students in all divisions of the College as well as the Departments of Psychology and Sociology in the College of Arts and Sciences. Research of a basic, applied, or methodological nature is encouraged and supported by the Institute.

GRADUATE ASSISTANTSHIPS

A number of graduate assistantships are available in the Institute. Students admitted to graduate study in any division of the College and in the Departments of Psychology and Sociology are eligible for these assistantships. Inquiries may be directed to the director or to the chairman of the department in which the student is registered.

Division of Clinical Studies

The Division of Clinical Studies includes the program areas of Counseling and Guidance, Reading, Rehabilitation Counseling, Special Education, and Speech Pathology and Audiology. The Division offers three programs leading to the Master of Arts and two programs leading to the Master of Science degree. The degree of Doctor of Education is offered in the area of Counseling and Guidance, Reading, Special Education and Speech Pathology and Audiology.

The candidates for graduate degrees must meet the general regulations of the Graduate School, the College of Human Resources and Education, and specific regulations as required of the Division programs. Descriptions of the admission, curriculum, and degree requirements are shown in each of the respective program sections.

REQUIREMENTS FOR ADMISSION TO CANDIDACY FOR THE MASTER OF ARTS DEGREE IN COUNSELING AND GUIDANCE, READING, AND SPECIAL EDUCATION

Graduate students shall apply to the Committee on Admissions of the respective programs for admission to candidacy for the Master's Degree. Applicants who have undergraduate grade-point averages of 2.5 or better may be admitted to candidacy when they have met the following requirements:

1. A maximum of 14 semester hours of graduate credit completed prior to admission to candidacy. At least 6 of these hours must be in the areas of Counseling and Guidance, Education, Reading, and/or Special Education and must have been taken in residence at West Virginia University. No more than 9 hours may be taken in extension prior to their completion of 6 hours in residence at the University.

2. A satisfactory score on the Graduate Record Examination and such other preliminary examinations as the Division of Clinical Studies or respective programs may prescribe.

3. Applicants who do not meet the above criteria may petition the Committee on Admission for individual consideration. A candidate conditionally admitted, who upon completion of a maximum of 15 semester hours of approved graduate work in residence, has not achieved a grade-point average of 3.0 shall be reclassified as a special graduate student, not eligible to be awarded a Master's Degree in the Division of Clinical Studies.

SPECIAL REQUIREMENTS FOR THE MASTER OF ARTS DEGREE IN COUNSELING AND GUIDANCE, READING, AND SPECIAL EDUCATION

1. No student may be awarded a Master's Degree unless the student has a minimum grade-point average of 2.5 on all work taken for graduate credit. (A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.)

2. No student may repeat a required graduate course more than once.

3. Fifteen semester hours of approved work in extension may apply toward the completion of degree requirements, if no work is transferred from another institution.

4. No more than 6 semester hours of approved transfer credit from another institution may be applied toward the degree.

5. No more than 9 hours of extension work may be used toward the degree if 6 hours of transfer credit from another institution is applied toward the degree.

6. Requirements for the Master's Degree must be completed within a period of seven years.

7. A final examination (oral, written, or both, at the discretion of the candidate's advisory committee).

A candidate who fails the final Master's degree examination may, upon written consent of his advisory committee, be given a second examination not earlier than the following term or semester. A candidate who fails the second examination may, upon written request and with the consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

COUNSELING AND GUIDANCE

CURRICULUM FOR COUNSELORS

Degree: Master of Arts

I. Required Courses	Program ¹	A	B	C
Ed. 301	3	3	3	
C&G 373	3	3	3	
C&G 374	2	2	2	
C&G 375	3	3	3	
C&G 376	3	3	3	
C&G 377	3	3	3	
C&G 378	2	2	2	
C&G 360	0	3	0	
C&G 361	6	0	0	
C&G 395	3	3	3	
TOTAL	28	25	.22	
II. Approved Electives		2	5	14
Ed. 211, 271, 348, 349.				
C&G 270, 313, 324, 362, 395, 398.				
Psych. 243, 251, 252, 261, 263, 264, 271, 281, 282, 323.				
Rdg. 300.				
Soc. 210, 211, 233, 234, 244.				
Speech 275.				
SPA. 250.				
Sp. Ed. 368, 369, 371.				
Stat. 211.				
TOTAL FOR MASTER'S DEGREE	30	30	36	

¹A—Thesis required

B—Research problems required

C—36 semester hour program for counselors

Completion of this curriculum fulfills the scholastic requirements for a Master's Degree in Counseling and Guidance at West Virginia University. Requirements for a School Counselors Certificate in West Virginia are: (1) completion of the Master's Degree in Counseling and Guidance, (2) a professional Certificate at the level at which the counseling is to be done, (3) 2 years of successful teaching experience at the level at which the counseling is to be done.

COUNSELING AND GUIDANCE

270. SPECIAL PROBLEMS AND WORKSHOPS IN COUNSELING AND GUIDANCE. I, II, S. 2-4 hr. PR: Consent. To take care of credits for special workshops and short intensive limit course on methods, supervision and other special topics.

313. ELEMENTARY-SCHOOL GUIDANCE. I, II, S. 3 hr. PR: Consent. Practical application of the principles of guidance to the elementary school.

324. ADMINISTRATION OF INDIVIDUAL INTELLIGENCE TESTS. I, II, S. 4 hr. PR: Consent. Techniques in administering, scoring, and interpreting individual mental ability tests.

360. PROBLEM IN COUNSELING AND GUIDANCE. I, II, S. 3 hr. Research for Master's degree in Counseling and Guidance.

361. THESIS IN COUNSELING AND GUIDANCE. I, II, S. 6 hr. Research for Master's degree in Counseling and Guidance.

362. PROJECT IN COUNSELING AND GUIDANCE. I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Counseling and Guidance.

373. BASIC COURSE IN GUIDANCE. I, II, S. 3 hr. An overview of a total guidance program.

374. EDUCATIONAL AND OCCUPATIONAL INFORMATION SERVICE. I. S. 2 hr. PR: C&G 373. Methods of gathering and disseminating occupational and educational information.

375. INDIVIDUAL AND GROUP INVENTORY TECHNIQUES. I, II, S. 3 hr. PR: C&G 373 and consent. Comprehensive study of all objective measures used in schools; techniques of administering and interpreting to individual and groups; developing testing programs and costs.

376. COUNSELING TECHNIQUES AND SPECIAL COUNSELING PROBLEMS. I, II, S. 3 hr. PR: C&G 373, 374, 375. Analytical consideration of identifying causes and development of psychological maladjustments. Seminar study of counseling techniques with practice under supervision.

377. ADVANCED STUDIES OF HUMAN ADJUSTMENT. I, II, S. 3 hr. PR: C&G 373, 374, 375, 376. Clinical consideration of identification, causes, and development of psychological maladjustments: further study of developments in counseling and background in advanced studies in guidance.

378. ORGANIZATION AND ADMINISTRATION OF GUIDANCE. II, S. 2 hr. PR: C&G 373, 374, 375, 376. Operation of guidance program in terms of personal functions, relationships, physical facilities, instructional integration, financial standards, law and regulations.

395, 396, 398. PRACTICUM. I, II, S. 24 hr. per sem. or term aggregating not more than 12 hr. PR: 8 graduate hr. in Counseling and Guidance. Enrollment with permission of adviser or instructor in consultation. Special individual and group projects. To provide appropriate residence credits for special workshops, prolonged systematic conferences on problems and projects in Counseling and Guidance. Credits in these projects cannot be substituted for required courses.

READING

CURRICULUM FOR SECONDARY-SCHOOL CLASSROOM TEACHERS—READING

Degree: Master of Arts

I. <i>Required Courses</i>	6 hr.
Ed. 336	3
C&G 373 or Ed. 331	3
II. <i>Approved Electives</i>	6 hr. (Min.)
C&G 324, 375	
Ed. 221, 271, 285, 301, 331, 337, 339, 346, 348, 351, 360, 361, 367, 385.	
Psych. 218, 233.	
Sp. 275.	
SPA. 250.	
III. <i>First Teaching Field—Reading</i>	18 hr.
Rdng. 282	3
Rdng. 300	3
Rdng. 301	3
Rdng. 302	3
Rdng. 304	3
Rdng. 305	2
Rdng. 306	3
Rdng. 307	2
Rdng. 308	2
Rdng. 310	3
Rdng. 398	3
Sp. Ed. 347	3
IV. <i>Second Teaching Field</i>	6 hr. (Min.)
TOTAL HOURS	36

NOTE: Students who desire to complete the reading program with 27 hours of course work and a 3-hour problem should check with the adviser for requirements.

CURRICULUM FOR ELEMENTARY-SCHOOL CLASSROOM TEACHERS—READING

Degree: Master of Arts

I. <i>Required Courses</i>	Program	A	B
Ed. 271		3	3
Ed. 301		3	0
Ed. 306 or 307		0	3
Ed. 335		0	3
Ed. 348 or 349		0	3
Rdng. 300		3	3
Rdng. 304		3	3
Rdng. 306		3	3
Rdng. 360		3	0
	18		21
II. <i>Approved Electives</i>		6	6
Ed. 202, 221, 324, 331, 346, 370, 385.			
C&G 313, 324, 373, 375.			
Psych. 218, 233.			
SPA. 250, or Sp. 275.			
Sp. Ed. 347, 368, 369, 371.			
CDFR 276, 286.			
III. <i>Specialized Electives</i> ¹		6	6
Rdng. 282, 301, 302, 305, 307, 308, 310, 398.			
Sp. Ed. 347.			
TOTAL HOURS		30	36

¹Any course from the specialized category may be used as an approved elective.

READING

270. SPECIAL WORKSHOP IN READING. I, II, S. 3 hr. A course designed for in-service training of teachers—both elementary and secondary. Regularly offered as an extension course, the chief emphasis is upon the organization of reading programs in the elementary and secondary schools.

282. READING FOR CLASSROOM TEACHERS. 3 hr. PR: Consent. A course designed to provide for in-service teacher education and for pre-service instruction in reading methods for undergraduate and graduate elementary and secondary teachers.

300. FOUNDATIONS OF READING INSTRUCTION. I, S. 3 hr. A basic course in teaching reading, grades 1-12. It is planned to give students who have little or no background in reading an opportunity to study the reading process and to learn how to apply effective techniques and methods to classroom teaching of reading.

301. TEACHING THE LANGUAGE ARTS. I, S. 3 hr. PR: Consent. A study of the inter-relationship among the different phases of the language arts. Special attention is given to organizing the language arts program, selecting materials and equipment, and understanding effective techniques and methods for teaching, listening, oral language, written language, handwriting and spelling.

302. PRACTICUM. SECONDARY READING INSTRUCTION. I, II, S. 3 hr. PR: RDNG 282 or consent. A course designed to provide an understanding of the reading skills essential at the high school level and how they may be developed in the various subject matter areas covered in the secondary school.

304. CORRECTIVE TECHNIQUES IN READING INSTRUCTION. II, S. 3 hr. PR: Rdng. 309. A basic course in corrective reading for classroom teachers. Special emphasis on the correction of reading difficulties by the classroom teacher with equipment and materials available to the average classroom.

305. SURVEY OF MAJOR ISSUES IN READING. II, S. 2 hr. PR: Rdng. 309. An advanced course in the major problems confronting the teacher or supervisor of reading instruction. Essentially a research course in which each student will have the opportunity to complete an individual problem in an area of special interest.

306. SPECIAL PROBLEMS IN CLINICAL READING. I, II, S. 3 hr. PR: Rdng. 300, 304. A laboratory course in remedial reading. Major emphasis will be placed upon tutoring remedial cases in the Reading Center.

307. PRACTICUM. DIAGNOSIS OF READING DIFFICULTIES. I, II, S. 2 hr. PR: Rdng. 300. Advanced instruction in determining the cause of reading difficulties. Emphasis will be placed upon the use of standardized tests, informal tests, machines, and observation in determining the cause of reading difficulties.

308. PRACTICUM. CORRECTION OF READING DIFFICULTIES. I, II, S. 2 hr. PR: Rdng. 307. Advanced instruction in the correction of reading difficulties. Major emphasis will be placed upon methods of teaching, the use of machines and commercial materials, constructing and using teacher-made exercises, and evaluating progress.

310. PRACTICUM. CLINICAL READING. I, II, S. 3 hr. PR: Rdng. 306. Special problems in clinical reading. An advanced laboratory course in remedial reading. Major emphasis will be placed upon the diagnosis and treatment of reading difficulties.

360. PROBLEM IN READING. I, II, S. 3 hr. Research for Master's degree in Reading.

361. THESIS IN READING. I, II, S. 6 hr. Research for Master's degree in Reading.

362. PROJECT IN READING. I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Reading.

398. PRACTICUM. ORGANIZING THE READING PROGRAM. I, II, S. 2 hr. A course designed for supervisors, teachers, or principals who desire specialized experiences in organizing the reading program in all types of schools, grades one through college.

REHABILITATION COUNSELING

The program in Rehabilitation Counseling provides graduate professional education for counseling in rehabilitation. The College of Human Resources and Education through its Division of Clinical Studies and the College of Arts and Sciences through its Department of Psychology cooperate in the interdepartmental curriculum.

The degree of Master of Science with a major in Rehabilitation Counseling is offered in recognition of the growing need for specialized interdisciplinary training in this field.

REQUIREMENTS FOR ADMISSION

The applicant must meet admission requirements of the Graduate School and the Program Admission Committee. The applicants must bring a broad liberal arts training including no fewer than 24 semester hours, or the equivalent, in Economics, Education, History, Philosophy, Political Science, pre-Social Work, Psychology, or Sociology. There must be a concentration of at least 12 semester hours in one of these fields.

REQUIREMENTS FOR COMPLETION

1. Completion of an approved program totaling not fewer than 42 semester hours. In most cases the program will range between 42 and 48 hours.
2. Completion of 10 to 12 semester hours of supervised clinical practice (internship) under faculty direction in a rehabilitation setting.
3. Demonstration of competence in the theory and practice of rehabilitation counseling to the satisfaction of the faculty in charge of the program. This will include passing a comprehensive final examination, oral or written or both, at the discretion of the faculty. A thesis will not be required. A candidate must also demonstrate, as he proceeds in the program, the ability to assume the degree of responsibility required of a professional counselor, and the personal characteristics essential to effective working relationships with others.

CURRICULUM FOR REHABILITATION COUNSELING

The minimum curriculum in each area is set out below, allowing flexibility for adaptation to student backgrounds. Courses may be selected by the student with the consent of the adviser.

	Hr.
<i>I. Counseling</i> (Minimum: 6 semester hours)	
Counseling and Guidance 373—Basic Course in Guidance	3
Psychology 375—Counseling and Psychotherapy	1-3
Counseling and Guidance 376—Counseling Techniques and Special Counseling Problems	3
Psychology 307—Practicum in Industrial Interviewing	3
Rehabilitation Counseling 390—Counseling Practicum	3
<i>II. Evaluative Techniques</i> (Minimum: 5 semester hours)	
Counseling and Guidance 375—Individual Inventory Techniques ..	3
Psychology 262—Group Psychometric Testing	3
Psychology 371—Individual Intelligence Testing	3
Counseling and Guidance 324—Administration of Individual Psychology 203—Personnel Psychology	3
Psychology 261—Individual Difference	3
Intelligence Tests	4
<i>III. Occupational Information</i> (Minimum: 3 semester hours)	
Rehabilitation Counseling 384—Seminar in Occupations & Placement	3
Psychology 202—Job Analysis	3
<i>IV. Dynamics of Human Behavior</i> (Minimum: 6 semester hours)	
Psychology 263—Introduction to Personality	3
Psychology 281—Abnormal Psychology	3
Psychology 264—Psychology of Adjustment	3
Psychology 271—Introduction to Clinical Psychology	3
Sociology 244—Culture and Personality	3
Psychology 381—Behavior Pathology	3

V. Community Organization (Minimum: 3 semester hours)			
Sociology 208—The Community	3		
Sociology 260—Complex Organizations		3	

VI. Rehabilitation Counseling (Minimum: 13 semester hours)

REHABILITATION COUNSELING

370. **SEMINAR IN MEDICAL VOCATIONAL ASPECTS.** I. 3 hr. PR: 21 hr. in social sciences or education. Contribution of medicines in the rehabilitation process from referral to vocational placement of handicapped persons.

384. **SEMINAR IN OCCUPATIONS AND PLACEMENT.** I, II. 3 hr. PR: 21 hr. in social sciences or education. A study of occupational theory, placement, process, personnel practices, job evaluation, and medicolegal aspects for work as they pertain to rehabilitation.

386. **SPECIAL PROBLEMS.** II, S. 1-3 hr. Rehabilitation theory and techniques in problems such as blindness, epilepsy, and mental retardation. Course also provides for concentrated study in special institutes.

387. **CLINICAL PRACTICE.** I, II, S. 1-12 hr. PR: Consent, following at least one academic semester in classroom. Clinical practice (internship) in selected agencies, rehabilitation centers, clinics, or hospitals conducting an organized program of services for the mentally or physically handicapped. Such practice will be under the direct supervision of faculty and agency personnel.

388. **INTRODUCTION TO VOCATIONAL REHABILITATION.** I. 3 hr. A study of problem and extent of disablement, historical development and legal basis, concepts, processes, and case development techniques in vocational rehabilitation as a public service to the mentally and physically handicapped.

389. **SEMINAR.** I, II, S. 1-6 hr. PR: Consent. Course is designed to provide opportunity for critical study in selected areas of rehabilitation including counseling theories and issues.

390. **COUNSELING PRACTICUM.** I, II, S. 3 hr. PR: Graduate standing and consent. Counseling techniques dealing with the theory and practice of rehabilitation counseling.

391. **DIRECTED STUDY AND RESEARCH.** I, II, S. 1-3 hr. PR: Consent. Directed reading and/or research in special rehabilitation areas.

Elective hours may be selected from the departmental offerings above, or upon recommendation of the adviser from Economics, Genetics, Management, Nursing, Education, Political Science, Sociology, Speech and others.

SPECIAL EDUCATION

CURRICULUM FOR CLASSROOM TEACHERS IN SPECIAL EDUCATION

Degree: Master of Arts

I. Required Courses	Program	A	B	C
Sp. Ed. 223		3	3	3
Sp. Ed. 250		3	3	3
Sp. Ed. 323		3	3	3
Sp. Ed. 347		3	3	3
Sp. Ed. 360	0	3	0	
Sp. Ed. 361		6	0	0
Sp. Ed. 368		3	3	3
Sp. Ed. 369		3	3	3
C&G 375		3	3	3
Ed. 301	3	3	0	
Psych. 281		0	0	3
Psych. 264		0	3	3
TOTAL		<hr/> 30	<hr/> 30	<hr/> 27

	Program	A	B	C
II. <i>Approved Electives</i>	0	0	9	
C&G 313, 324, 373, 374, 376.				
Ed. 221, 271, 301, 308, 317, 331, 335, 336, 348, 349.				
Psych. 263, 271, 282, 323.				
Rdng. 282, 300, 304.				
Sp. Ed. 270, 362, 371, 395, 396, 397, 398.				
SPA 250.				
TOTAL FOR MASTER'S DEGREE	30	30	36	

SPECIAL EDUCATION

223. STUDENT TEACHING CLINICAL EXPERIENCE IN SPECIAL EDUCATION. I, II, S. 3 hr. PR: Consent. This is an advanced course in student teaching.

250. INDUSTRIAL ARTS IN SPECIAL EDUCATION. II, S. 3 hr. Experimentation with industrial arts crafts suitable for instruction in special education classes. Discussion of factors involved in selection and manipulation of such media as leather, plastics, ceramics, wood, and metal.

270. SPECIAL PROBLEMS AND WORKSHOP IN SPECIAL EDUCATION. I, II, S. 2-4 hr. PR: Consent. To take care of credits for special workshops and short intensive unit course on methods, supervision, and other special topics.

323. MATHEMATICS FOR THE MENTALLY RETARDED. I, S. 3 hr. PR: Consent. Materials and methods for teaching mathematics to the mentally retarded child.

347. READING FOR MENTALLY RETARDED CHILDREN. I, S. 3 hr. Designed especially for majors in Special Education, Emphasizes the techniques, methods, and materials most effective for teaching reading to subnormal children.

360. PROBLEM IN SPECIAL EDUCATION. I, II, S. 3 hr. Research for Master's degree in Special Education.

361. THESIS IN SPECIAL EDUCATION. I, II, S. 6 hr. Research for Master's degree in Special Education.

362. PROJECT IN SPECIAL EDUCATION. I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Special Education.

368. NATURE AND NEEDS OF EXCEPTIONAL CHILDREN. I, II, S. 3 hr. PR: Consent. Etiology, philosophy, and education of mentally retarded, physically handicapped, and mentally advanced. Overview of identification of exceptional children, their training and possibility of placement.

369. CURRICULUM, MATERIALS, AND METHODS FOR THE MENTALLY RETARDED. I, II, S. 3 hr. PR: Consent. History and philosophy of teaching the mentally retarded. Identification, curriculum, materials and methods of teaching the mentally retarded.

371. CURRICULUM, MATERIALS, AND METHODS FOR MENTALLY GIFTED. I, II, S. 3 hr. History and philosophy, identification, curriculum, materials and methods of working with mentally gifted.

395, 396, 398. PRACTICUM. I, II, S. 2-4 hr. per sem. or term aggregating not more than 12 hr. PR: 8 graduate hr. in Special Education. Enrollment with permission of adviser or instructor in consultation. Special individual and group projects. To provide appropriate residence credits for special workshops, prolonged systematic conferences on problems and projects in Special Education. Credits in these projects cannot be substituted for required courses.

SPEECH PATHOLOGY AND AUDIOLOGY

MASTER OF SCIENCE IN SPEECH PATHOLOGY AND AUDIOLOGY

Persons who possess a Bachelor's degree from an accredited college or university may be admitted to a program leading to candidacy for the degree of Master of Science in Speech Pathology and Audiology, provided that they (1) present evidence of ability to pursue graduate work successfully as measured by the Graduate School standards for admission, and additional divisional and academic area requirements, (2) provide evidence, through written recommendations or successful professional experience, of the personal qualities predictive of professional success, and (3) show adequate academic preparation in the basic and background courses in speech and hearing science and appropriate physical and social sciences. Any deficiencies in undergraduate preparation will be made up either without credit or added to the credit required for the degree.

Divisional requirements for the achievement of the Master of Science degree are as follows:

1. Completion of a minimum of 33 semester hours of approved graduate courses in speech science and pathology and audiology, and such others in related areas as may be required to attain professional competence, achieving not less than a "B" average for all courses taken for credit toward the graduate degree.
2. Fulfillment of one of the two following alternatives:
 - a. Submission of an approved thesis or problem report for which up to 6 semester hours of credit may be given, or
 - b. Successful completion of an additional 6 semester hours of 300 level courses to fulfill the 33 semester hour minimum requirement.
3. Successful passage of oral and/or written final comprehensive examinations according to Graduate School and Divisional standards and procedures.
4. Demonstration of professional competence in clinical speech and/or hearing as measured by fulfillment of the academic and practical requirements required for existing certification standards.

DOCTOR OF EDUCATION IN SPEECH PATHOLOGY AND AUDIOLOGY

The degree of Doctor of Education is offered. For the prerequisites to admission, conditions for admission to candidacy, and general requirements for the degree, see the description of degree requirements in the Division of Education section.

In order to fulfill the specific requirements of the doctoral degree with an academic concentration in speech pathology and audiology, the candidate must possess the personal and professional qualification predictive of potential success in a clinical and scientific field.

The choice of courses comprising the program will be determined by an evaluation of the needs of the individual student. However, at least one-half of the courses above the Bachelor's degree will be chosen from the specialized offerings in speech pathology and audiology. The remainder will be chosen from education, psychology, and such other areas as may be approved by the candidate's committee as related and appropriate.

Candidates having an earlier graduate degree from West Virginia University will be required to complete a prescribed minimum of resident graduate work in one or more other institutions.

SPEECH PATHOLOGY AND AUDIOLOGY

250. **SURVEY OF ORAL COMMUNICATION DISORDERS. II. 3 hr. PR: Consent.** A survey of basic concepts and principles of the disorders of speech and their treatment. Students observe examination and corrective methods of therapists in the clinic and schools. Normal speech and hearing development of children is considered. This is an orientation course for students majoring in speech as well as teachers, school administrators, psychologists, and rehabilitation workers.
251. **ADVANCED SPEECH CORRECTION. II. 3 hr. PR: SPA 156.** Study of the speech-retarded child and organically based speech disorders including cleft palate, cerebral palsy, esophageal speech, and phonation.

252. STUTTERING. I. 3 hr. PR: SPA 156. Theories and therapies of stuttering.

253. PROFOUND ORGANIC SPEECH DISORDERS. II. 3 hr. PR: SPA 251 or consent. Speech and language disorders related to cerebral injury. Emphasis on aphasia and aphasia therapeutics. Differential diagnosis of children with delayed speech and language.

271. DIAGNOSTIC AUDIOMETRICS. I. 3 hr. PR: SPA 157 and consent. A study of the various audiometric tests outlining the dimensions of hearing. Test administration and interpretation.

272. HARD OF HEARING THERAPY. II. 3 hr. PR: SPA 158 or consent. Bases and procedures of acoustic training and speech reading.

276. PROCEDURES AND METHODS IN CLINICAL SPEECH AND HEARING. I. 3 hr. PR: SPA 156, 157. Principles and methods of diagnosis and appraisal of disorders of communication. Methods of organization and administration of clinical speech and hearing programs in schools, hospitals, community clinics, and state and national services.

277. CLINICAL PRACTICE IN SPEECH. I, II. 1-6 hr. PR: Consent. Supervised diagnosis and therapy of speech disorders. (May be taken for a maximum of 3 semester hours per semester of undergraduate or graduate credit.)

278. CLINICAL PRACTICE IN HEARING. I, II. 1-6 hr. PR: Consent. Supervised diagnosis and therapy of hearing disorders. (May be taken for a maximum of 3 semester hours per semester of undergraduate or graduate credit.)

350. EXPERIMENTAL PHONETICS. II. 3 hr. PR: SPA 153 and consent. Investigation of problems of phonetics as they are related to functional speech. Instruments used in sound analysis and an investigation of various aspects of architectural acoustics.

351. PROBLEMS IN SPEECH PATHOLOGY. I. 3 hr. PR: Consent. The speech pathologist as a diagnostician and therapist in interdisciplinary investigations. Examination of counseling procedures, administrative practices in varied settings, and organization of programs for various pathologies of speech.

352. ADVANCED SPEECH PATHOLOGY. II. 3 hr. PR: SPA 251 and consent. Theories of causation and therapies for delayed language development, cleft palate, and cerebral palsy.

353. NEUROPATHOLOGIES OF SPEECH AND LANGUAGE. I. 3 hr. PR: SPA 154, 253, or consent. Speech and language disturbances related to brain injury or maldevelopment. Consideration of the neurological bases, pathologies and psychological factors involved in the loss or lack of development of speech and language.

357. SEMINAR: PROBLEMS IN AUDIOLOGY. I. 3 hr. PR: SPA 158, 271. Topics vary from term to term to meet student needs. Emphasis will be an advanced concepts in audiological diagnosis, aural rehabilitation and noise in industry.

358. ACOUSTIC INSTRUMENTATION. II. 3 hr. PR: SPA 158, 271. Principles of electronic design utilized in clinical auditory testing and amplification. Evaluation and assessment of hearing aids in aural rehabilitation.

359. SEMINAR: SPEECH PATHOLOGY. I. 3 hr. PR: Consent.

360. SEMINAR: SPEECH AND HEARING SCIENCE. I. 3 hr. PR: Consent. Consideration of contemporary research in speech pathology, audiology, and related scientific fields. Experimental methodology and instrumentation. Individual student projects.

375. INDEPENDENT STUDY. I, II. 1-3 hr. PR: Consent. Open to graduate students in speech pathology and audiology who are pursuing independent problems in that field. May be repeated.

397. RESEARCH I, II. 1-3 hr. PR: Consent. For Graduate students in speech pathology and audiology. May be repeated.

399. THESIS. I, II. 2-4 hr.

Division of Education

The Division of Education is comprised of resident courses of instruction and facilities for research; University High School with its opportunities for observing, student teaching, directed supervision, and experimentation; and cooperating elementary and secondary schools for supervised student-teaching experience.

Programs are accredited by the National Council for Accreditation of Teacher Education for the preparation of elementary teachers, secondary teachers, school service personnel, and school administrators, with the Doctor's degree as the highest degree approved.

MASTER OF ARTS

REQUIREMENTS FOR ADMISSION TO GRADUATE WORK IN EDUCATION

It is the responsibility of all applicants for admission and all candidates for graduate degrees and certificates to conform to the general regulations of the Graduate School.

REQUIREMENTS FOR ADMISSION TO CANDIDACY FOR THE MASTER'S DEGREE IN EDUCATION

Graduate students apply to the Office of Admissions for admission. Scores on the Aptitude Test of the Graduate Record Examination should accompany the application but must, in all cases, be submitted to the Graduate Dean prior to completion of the first 15 semester hours of graduate study. Students may take no more than 9 semester hours in extension prior to completion of at least 6 semester hours in residence. Conditions of Admission to the master's degree programs in education follow.

For admission to candidacy for the Master's Degree in Education, students must have a professional teaching certificate based upon an approved teacher education program or at least 20 semester hours of approved undergraduate credit in education.

Students may be admitted as degree candidates on submission of a minimum composite score of 950 on the Aptitude Test of the Graduate Record Examination, or an undergraduate grade-point average of 2.5 (based on a 4-point system). These students may pursue the program of their choice immediately.

Students who do not meet either of the above admission requirements may take a maximum of 15 semester hours of course work. At the end of this period students may apply to the Committee on Admissions for review of their admissions classification. Re-classification will be considered *only* in cases in which the student has achieved a *minimum* grade-point average of 3.0 for the first 15 semester hours of graduate study. All work taken up to the conclusion of the term in which the fifteenth semester hour is earned will be used in computing the grade-point average. If the student is not re-classified to degree program status by the Committee on Admissions, he is not eligible to continue graduate study in the Division of Education.

OPTIONAL ROUTES TOWARDS A MASTER'S DEGREE IN EDUCATION

A. Thirty semester hours, including 6 semester hours of research (Ed. 361, Thesis). Examination (oral, written, or both, at the discretion of the candidate's advisory committee.);

B. Thirty semester hours, including 3 semester hours of research (Ed. 360, Problem), selected in conference with the candidate's committee, directed by the adviser, with final approval by the committee and 27 semester hours of course work. Examination (oral, written, or both, at the discretion of the candidate's advisory committee.);

C. Thirty-six semester hours, including 15 semester hours of course work. Examination (oral, written, or both, at the discretion of the candidate's advisory committee.); and

D. Program options D and E are offered in several programs.

SPECIAL REQUIREMENTS FOR THE MASTER'S DEGREE IN EDUCATION

1. No student may be awarded a Master's degree in Education unless the student has a minimum grade-point average of 2.5 on all work taken for graduate credit. (A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.)
2. No student will be permitted to repeat a required graduate course more than once.
3. Fifteen semester hours of approved courses in extension may apply toward the completion of degree requirements, if no work is transferred from another institution. A maximum of 12 hours of approved extension courses may be used for certification.
4. The maximum number of hours which may be used from extension courses is 9, if 6 semester hours of approved transfer credit from another institution is used toward the degree.
5. Students are limited to earning 9 hours in any one field in extension.
6. Requirements for the Master's Degree in Education must be completed within a period of seven years.

NOTE: All persons working toward administrative certificates in Education or who wish to add additional administrative certification shall be required to pass a screening examination.

NOTE: A candidate who fails the final Master's degree examination may, upon written consent of his advisory committee, be given a second examination not earlier than the following term or semester. A candidate who fails the second examination may, upon written request and with the unanimous consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

GRADUATE PROFESSIONAL EDUCATION CURRICULA

Graduate Professional Education Curricula are offered in two major areas within the Division:

I. Administration

Elementary School Principals
High School Principals
Superintendents

II. Curriculum and Instruction

Elementary-School Classroom Teachers
Home Economics Education
Industrial Arts Teachers
Secondary-School Classroom Teachers
Supervisors of Instruction
Teacher Librarians

The administrative certificates issued by the State Department of Education for superintendents, principals (elementary and secondary) and supervisors are called Professional Administrative Certificates.

CURRICULUM FOR SUPERINTENDENTS*

Degree: *Master of Arts*

<i>I. Required Courses</i>	Program	A	B	C
Ed. 271		3	3	3
Ed. 301		3	3	3
Ed. 331		3	3	3
Ed. 335 or 336		3	3	3
Ed. 339		3	3	3
Ed. 340		0	3	3
Ed. 342		3	3	3
Ed. 346		3	3	3
Ed. 353 or 356		3	3	3
Ed. 360		0	3	0
Ed. 361		6	0	0
TOTAL		30	30	27
 <i>II. Approved Electives</i>				
Ed. 270, 284, 306, 307, 308, 326, 327, 340, 341, 343, 344, 345, 350, 367, Rdng. 300 and/or academic courses approved by the adviser. (Academic deficiencies will have first consideration.)		0	0	9
TOTAL FOR MASTER'S DEGREE		30	30	36

*A minimum of 5 years experience and a health certificate are required.

Program A—Thesis required

Program B—Research problem required

Program C—36 semester hour program

NOTE: For those who already hold a Master's degree and who wish to qualify for the University's recommendation for a Superintendent's Certificate, the following courses will satisfy:

<i>Required Courses</i>	19 Hr.
General Administration: Ed. 339, 340, 342, or 343 or 344	6-9 Hr.
Elementary-school Administration: Ed. 335*, 356	3-6 Hr.
Secondary-school Administration: Ed. 336*, 346, 353	3-6 Hr.
Introduction to Educational Research: Ed. 301	3 Hr.

*Ed. 335 or 336 (not both) can be accepted.

CURRICULUM FOR HIGH SCHOOL PRINCIPALS

Degree: *Master of Arts*

<i>I. Required Courses</i>	Program ¹	A	B	C	D	<i>Options</i>
Ed. 271		3	3	3	3	
Ed. 301		3	3	3	3	
Ed. 327		3	3	3	3	
Ed. 328		0	0	0	2	
Ed. 336 or 346		3	3	3	3	
Ed. 338		0	0	0	2	
Ed. 339		3	3	3	3	
Ed. 353		3	3	3	3	
Ed. 360		0	3	0	0	
Ed. 361		6	0	0	0	
TOTAL		24	21	18	22	

*A—Thesis required

B—Educational Research Problem required

C—36 semester hour program

D—Fulfills NCATE requirements

II. Approved Electives²

Ed. 259, 270, 284, 285, 322, 331, 341, 348, 349, 385	6	6	6	5
Sp. Ed. 371				
C&G 373				

III. Approved Academic Courses³

TOTAL HOURS FOR MASTER'S DEGREE	0	3	12	9
	—	—	—	—

²Appropriate graduate courses related to the high school principalship may be submitted in the approved elective area with the adviser's consent.

³Academic courses approved by the adviser should be selected in two or more high-school teaching fields.

General requirements for the West Virginia High School Principal's Certificate are: (1) Graduation from an accredited college or university and qualifications for a Professional Certificate valid in Grades 7-12; (2) three years of secondary-school teaching experience in Grades 7-12 (not in a one-room school); (3) a health certificate.

Each of the options meets the qualifications of a West Virginia High School Principal's Certificate. Option D meets the qualifications needed for NCATE certification.

Those already holding a Master's degree who desire to qualify for this certificate, will be required to have the courses listed in Section I and II.

CURRICULUM FOR ELEMENTARY SCHOOL PRINCIPALS¹

DEGREE: Master of Arts

Options

I. Required Courses:

	A ²	B ²	C ²	D ³
Ed. 301	3	3	3	3
Ed. 306 or 307	3	3	3	3
Ed. 308 or Rdng. 300	3	3	3	3
Ed. 315	0	0	0	2
Ed. 325	0	0	0	2
Ed. 326	0	0	0	2
Ed. 331 or 335	3	3	3	3
Ed. 339	3	3	3	3
Ed. 346	3	3	3	3
Ed. 356	3	3	3	3
Ed. 360	0	3	0	0
Ed. 361	6	0	0	0
	—	—	—	—
TOTAL	27	24	21	27

II. Approved Education Electives

C&G 313

Ed. 202, 221, 223, 259, 270, 271, 275, 284, 304, 305, 306, 307, 308, 315, 325, 326, 331, 335, 344, 348, 349, 370, 372, 380, 385

Rdng. 300, 301

3 6 5 0

III. Academic Courses Approved by Adviser

0 0 10 9

TOTAL HOURS FOR MASTER'S DEGREE	30	30	36	36
	—	—	—	—

¹A—Thesis required

B—Research problem required

C—36 semester hour program

D—Fulfills NCATE requirements

¹General requirements for the elementary-school principal's certificate are: (1) graduation from an accredited college or university and qualifications for Professional Certificate, valid Grades 1-9; (2) three years of elementary-school teaching experience in Grades 1-8; and (3) a health certificate. Since most of the courses in this curriculum have prerequisites, the consent of the adviser and the instructors must be obtained prior to enrollment.

²Completion of programs under this option meets requirements for the elementary-school principal's certificate, but does **not** meet NCATE requirements.

³Completion of program under this option fulfills requirements for NCATE certificate. Approval of adviser must be obtained before this program can be pursued.

CURRICULUM FOR SUPERVISORS OF INSTRUCTION†

DEGREE: *Master of Arts*

I. Required Courses	Program	NCATE			Non-NCATE		
		A	B	C	A ¹	B ¹	C ¹
Ed. 271		3	3	3	3	3	3
Ed. 301		3	3	3	3	3	3
Ed. 331			3	3	3	3	3
Ed. 339				3			3
Ed. 346		3	3	3	3	3	3
Ed. 360			3			3	3
Ed. 361			6			6	
II. NCATE Required Field Courses							
Ed. 380		2	2	2			
Ed. 381		2	2	2			
Ed. 382		2	2	2			
Ed. 383		2	2	2			
III. NCATE Required Courses for Problems in Teaching							
Ed. 306 or 307		3	3	3			
Rdng. 300 or 301		3	3	3			
IV. Non-NCATE Required Courses for Problems in Teaching (General or Special)							
Ed. 306 or 367					3	3	3
Ed. 307					3	3	3
Ed. 308					3	3	3
Rdng. 300 or 301					3	3	3
		—	—	—	—	—	—
		29	29	29	30	27	27
Approved Electives							
Ed. 259, 270, 331, 339, 348, and/or courses approved by the adviser		2	2	7		3	9
		—	—	—	—	—	—
REQUIRED HOURS FOR MASTER'S DEGREE		30	30	36	30	30	36

†A minimum of 3 years teaching experience and a health certificate are required.

A and A¹—Thesis required

B and B¹—Research problem required

C and C¹—36 semester hour program

NCATE Program meets requirements for certification in West Virginia. Non-NCATE Program does not meet the requirements for certification in West Virginia.

CURRICULUM FOR SECONDARY-SCHOOL CLASSROOM TEACHERS†

DEGREE: *Master of Arts*

I. Graduate Courses in Education		12-18 Hr.		
Required Courses		6 Hr.		
	Program ¹	A	B	C
Ed. 336		3	3	3
Ed. 331 or C&G 373		3	3	3
Ed. 271		3	3	0
Ed. 301		3	3	0
Ed. 360		0	3	0
Ed. 361		6	0	0
Ed. 397		0	0	0
	—	—	—	—
TOTAL		18	15	6

†NOTE: In some programs listed on pp. 195-197 a combination of undergraduate courses and courses listed in graduate program is necessary to meet certification requirements.

¹A—Thesis required

B—Research problem required

C—36 semester hour program

II. <i>Approved Electives</i>	6 Hr. (Min.)	
C&G 373, 375		
Ed. 221, 251, 259, 262, 270, 271, 274, 275, 284, 285, 301, 304, 305, 322, 331, 337, 338*, 339, 346, 348, 360, 361, 364, 367, 370, 371, 380*, 385, 395, 396, 397, 398		
Rdng. 300, 301		
III. <i>**Graduate Courses in one of the candidate's certified fields</i> ..	12-18 Hr.	
IV. <i>***Graduate Courses in another of the Candidate's teaching fields</i> ..	6 Hr. (Min.)	
V. <i>Free electives</i>	0- 6 Hr.	
	Alternate Program for II, III, IV	
I. <i>Graduate Courses in one of the candidate's certified teaching fields</i>	18-24 Hr.	
II. <i>Free electives</i>	0- 6 Hr.	
	TOTAL FOR MASTER'S DEGREE	30-36 Hr.

*May be taken as internship courses.

**Candidates with library science as a major teaching field must follow the curriculum for Teacher-Librarians.

***This provision does not apply to candidate pursuing Programs A or B.

CURRICULUM FOR INDUSTRIAL ARTS TEACHERS*

DEGREE: *Master of Arts*

	Program ¹	A	B	C
I. <i>Required Courses</i>				
Ed. 271	3	3	0	
Ed. 301	3	3	3	
Ed. 303	3	3	3	
Ed. 310	3	3	3	
Ed. 311	3	3	3	
Ed. 360	0	3	0	
Ed. 361	6	0	0	
Ed. 365	3	3	3	
TOTAL	24	21	15	
II. <i>Approved Electives</i>	6	9	21	
(Students electing Option C should maintain a close balance in total hours between professional and academic courses.)				
C&G 373, 374, 375				
Ed. 204 (IA), 221, 238 (IA), 240 (IA), 243 (IA), 244 (IA), 246 (IA), 248 (IA), 249 (IA), 251, 270, 271, 272, 275, 284, 285, 301, 319, 320, 321, 322, 324, 331, 336, 338, 339, 346, 348, 351, 353, 364, 370, 372, 385, 395, 396, 397, 398, 399.				
Sp. Ed. 250, 368, 369, 371				
TOTAL FOR MASTER'S DEGREE	30	30	36	

¹A—Thesis required

B—Research problem required

C—36 semester hour program

*See dagger NOTE on page 195.

CURRICULUM FOR ELEMENTARY SCHOOL CLASSROOM TEACHERS*

Degree: *Master of Arts*

I. Required Courses	Program ¹	A	B	C	D
Ed. 271	3	3	3	3	
Ed. 301	3	3	0	3	
Ed. 306	3	3	3	0	
Ed. 307	3	3	3	0	
Ed. 308	3	3	3	3	
Rdng. 300	3	3	3	3	
Ed. 331	3	3	3	3	
Ed. 335	3	3	3	0	
Ed. 360	0	3	0	3	
Ed. 361	6	0	0	0	
	—	—	—	—	—
TOTAL	30	27	21	18	
II. Approved Electives	0	3	15**	12	
Astron. 216					
C&G 313, 375					
Ed. 202, 221, 223, 270, 274, 285, 301, 306, 307, 315, 316, 317, 335, 348, 370, 372, 380, 385					
Math. 270, 271					
Rdng. 282, 301, 304, 305					
Sp. Ed. 347, 368, 371, or academic courses approved by the adviser. (Academic deficiencies will have first consideration.)					
	—	—	—	—	—
TOTAL FOR MASTER'S DEGREE	30	30	36	30	

¹A—Thesis required

B—Research problem required

C—36 semester hour program for classroom teacher and Elementary Mathematics

D—Concentration in Elementary Mathematics

*See dagger NOTE on page 195.

**At least 9 hours of electives must be in courses not offered by Education or Clinical Studies.

CURRICULUM FOR TEACHER-LIBRARIANS*

GRADUATE OPTION B ONLY

Degree: *Master of Arts in Education*

I. Graduate Courses in Education	12 Hr.
A. Required Courses in Education	6 Hr.
Ed. 301	
Ed. 360 (Library Science)	
B. Electives	6 Hr. (Min.)
C&G 373	
Ed. 221, 270, 271, 322, 331, 339, 385	
II. Graduate Courses in Library Science	12-18 Hr.
At least 6 hours must be in the 300 series.	
III. Electives	0- 6 Hr.
TOTAL FOR MASTER'S DEGREE	30 Hr.

*See dagger NOTE on page 195.

EDUCATION

202. **EARLY CHILDHOOD EDUCATION.** S. 2 hr. PR: Consent. Application of principles of psychology to early childhood education.

204. **ADVANCED WOODWORKING, CONSTRUCTION, AND FINISHING (IA).** II, S. 3 hr. PR: Ed. 102 (IA), 103 (IA), or equiv. Selection of advanced projects, analysis of construction, planning, and finishing, application of machine tools.

221. **AUDIO-VISUAL RESOURCES FOR INSTRUCTION.** I, II, S. 3 hr. PR: Ed. 105, 106. A survey is made of the many types of materials available for teaching. Multi-sensory techniques, sources of materials, and practical classroom utilization are considered. One hour laboratory period per week is arranged.

223. **STUDENT TEACHING CLINICAL EXPERIENCE IN ELEMENTARY SECONDARY, AND MATHEMATICS EDUCATION.** I, II, S. 2-4 hr. PR: Consent. This is an advanced course in student teaching, stressing clinical procedures in classroom learning problems, industrial arts therapy, and other related areas.

238. **DESIGN IN INDUSTRIAL EDUCATION (IA).** I, S. 3 hr. PR: Consent. Industrial education design; architectural drawing and model building. Emphasis on application of design components at the secondary school level.

240-250. These courses are designed to prepare versatile teachers of industrial arts and to meet State certification requirements. The abbreviated introduction to specific crafts through these courses is intended to provide broad rather than specialized experience and to prepare the teacher to teach the fundamentals of crafts rather than to attain vocational competence. Prospective teachers should elect, from these courses, those which will supplement their previous training in organizing and directing the industrial arts program.

240. **ART METAL AND JEWELRY (IA).** I, S. 3 hr. PR: Ed. 104 (IA) or equiv. Creative design and construction of art metal and jewelry involving the utilization of sheet, bar, and wire stock. Development of units suitable for the secondary school level is stressed.

242. **UPHOLSTERY AND FINISHING (IA).** I, S. 3 hr. PR: Ed. 102 (IA), 103 (IA) or equiv. and consent. Design and construction of upholstery units, reupholstery, finishing and refinishing. Construction of teaching units in these areas.

243. **ADVANCED CERAMICS (IA).** II, 3 hr. PR: Ed. 121 (IA) or consent. Design in ceramics, construction of projects involving mold work, potter's wheel, and hand form methods. Experimentation with glazes including glaze composition. Development of suitable teaching aids involving ceramics.

244. **ADVANCED INDUSTRIAL ARTS CRAFTS (IA).** II, S. 3 hr. PR: Ed. 121 (IA). Experiments with crafts media in depth in the areas of plastics and leather. Development of suitable teaching units involving crafts materials.

246. **ADVANCED INDUSTRIAL ARTS GRAPHICS (IA).** II, S. 3 hr. PR: Ed. 180 (IA) or equiv. Concentration in depth in one or more of the graphic arts media. Emphasis on offset methods of reproduction.

248. **ADVANCED ELECTRICITY (IA).** II, S. 2 hr. PR: Ed. 131 (IA) or equiv. A study of the technical phases of electricity with emphasis on planning shop courses, shop equipment and layout, and development in industrial aids.

249. **SHEET METAL PATTERN DEVELOPMENT (IA).** II, S. 3 hr. Layout problems involving parallel, radial, and triangulation methods. Construction of instructional units utilizing these principles.

251. **PRODUCTION OF AUDIO-VISUAL MATERIALS.** I, II, S. 2 hr. PR: Ed. 221. Techniques of making audio-visual materials for use in teaching and school public relations programs are demonstrated. Individual projects of planning and producing materials are carried out by the student.

259. **THE MUSIC EDUCATION PROGRAM.** S. 3 hr. PR or parallel: Ed. 124 or consent. Organization and administration of the complete Music Education program for grades 1 through 12.

262. VOCATIONAL HOME ECONOMICS IN SECONDARY SCHOOLS. II. 3 hr. PR or parallel: Ed. 120, 124, 163; 25 hr. in Home Economics. Primarily for seniors and teachers of home economics.

270. SPECIAL PROBLEMS AND WORKSHOPS. I, II, S. 2-4 hr. PR: 14 hr. in Education. To take care of credits for special workshops and short intensive unit courses on methods, supervision, and other special topics. Maximum of 8 semester hours may be applied toward the Master's degree, of which no more than 6 semester hours shall be in Extension.

271. EDUCATIONAL MEASUREMENT. I, II, S. 3 hr. PR: Consent. Background for educational measurement, the nature of evaluation, measuring and predicting pupil progress. Statistics includes measures of central tendency, percentiles, variability, and simple correlation. First course in statistics and research.

272. INTERNSHIP IN INDUSTRIAL ARTS THERAPY (IA). I, II, S. 8 hr. Internship in a clinical setting providing individualized instruction in the teaching techniques of industrial arts and therapeutic practices in rehabilitation of the handicapped.

274. WORKSHOP: ECONOMIC EDUCATION. S. 3 hr. A workshop for principals, teachers, and supervisors with emphasis on the economic structure of our society and methods of integrating economics into the school program. Sponsored jointly by the College of Human Resources and Education and the College of Commerce.

275. CURRICULUM PRINCIPLES AND PATTERNS IN GENERAL EDUCATION. II. 2 hr. PR: 6 hour undergraduate education and senior rank. Major emphasis on principles, philosophy, and concepts of general education in secondary schools; means and ends in general education: core, subject matter, integrated studies, broad fields, activity.

276. TEACHING YOUNG AND ADULT FARMER CLASSES. I, S. 2 hr. PR: Ed. 100, 105, 106. Participation in conducting young and adult farmer classes and school-community food preservation centers; organization, course of study, and methods of teaching and supervision, and young farmers' association.

277. ORGANIZING AND DIRECTING SUPERVISED FARMING PROGRAMS. II, S. 2 hr. PR: Ed. 160 or consent. Planning programs of supervised farming, supervising and evaluating such programs for all-day students, young farmers, and adult farmers.

284. PUPIL-PERSONNEL ADMINISTRATION. I, II, S. 2 hr. PR: Ed. 100, 105, 106. Pupil accounting, guidance, extracurricular activities, and control. Open only to senior students and graduates.

285. THE JUNIOR HIGH SCHOOL. I, II. 2 hr. PR: Ed. 100, 105, 106, and consent. Development, philosophy, program, and practices of the junior high school.

301. INTRODUCTION TO EDUCATIONAL RESEARCH. I, II, S. 3 hr. PR: Ed. 271 or 372. Required of all candidates for the administrative, supervisory, Options A and B for the Master's degree and several other programs. Methods, techniques, statistical measures, interpretations, and reporting of research.

303. HISTORY OF INDUSTRIAL EDUCATION. I, S. 3 hr. Survey of development of industrial education in Europe and America to 1917. Research on modern development since 1917 including contributions of contemporary leaders.

306. SOCIAL STUDIES IN THE ELEMENTARY SCHOOL. I, II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. Comprehensive consideration of objectives, content, methods, including unit procedures; materials including objects, models, exhibits, and museum items as well as textbooks, collateral reading, maps, and graphs; and means of evaluating social growth and development.

307. SCIENCE IN THE ELEMENTARY SCHOOL. I, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. An analysis of methods, curriculum patterns, and trends in elementary school science. Attention is given to the

understanding and development of scientific attitudes appropriate at the elementary school level.

- 308. MATHEMATICS IN THE ELEMENTARY SCHOOL. II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education or consent. Materials and methods of instruction for modern mathematics programs.
- 310. SCHOOL SHOP PLANNING. I, S. 3 hr. Selection, purchases, arrangement, installation and use of equipment for all instructional levels and types of school laboratories. Construction of 3-D scale models of typical industrial education laboratory facilities.
- 331. SCHOOL SHOP SAFETY PROGRAMS. II, S. 3 hr. Consideration of factors involved in school shop accidents; safety measures appropriate to schools and industry; theory of tort liability involving industrial education teachers.
- 315. CURRENT PRACTICES IN ELEMENTARY EDUCATION. I, II, S. 2 hr. PR: Consent. Critical analysis of modern techniques and practices in the elementary school.
- 316. CORRECTIVE TECHNIQUES IN MATHEMATICS EDUCATION. I, S. 3 hr. PR: Ed. 308. Materials and methods used in diagnosis and remediation of learning difficulties in mathematics.
- 317. SURVEY OF MAJOR ISSUES IN MATHEMATICS EDUCATION. II, S. 3 hr. PR: Ed. 308. Individual and group research on selected topics in mathematics education.
- 318. PLANNING PROGRAMS AND COURSES FOR VOCATIONAL AGRICULTURE DEPARTMENTS. I, S. 2 hr. PR: Ed. 124. Gathering data, studying the farming problems of all-day students, young farmers, and adult farmers, and planning the total program for the department.
- 319. SPECIAL PROBLEMS IN TEACHING GENERAL SHOP. S. 3 hr. PR: Ed. 107 (IA) or equivalent. Problems peculiar to teaching industrial arts in the general shop.
- 320, 321. SPECIAL TOPICS IN INDUSTRIAL ARTS. I, II, S. 2-3 hr. each. PR: Consent. For graduate students in industrial arts. Special projects of improvement in phases needing special attention.
- 322. ORGANIZING AUDIO-VISUAL PROGRAMS. II, S. 2 hr. PR: Ed. 221. Audio-visual techniques with emphasis on selection and utilization of materials, audio-visual centers, inservice programs, budgetary planning, and curricular implementation.
- 325. PRACTICE IN ADMINISTRATION IN ELEMENTARY SCHOOLS. I, II. 2 hr. PR: Consent. Practice in leadership pertaining to elementary school organization and administration according to the needs of the school and/or school system.
- 326. PRACTICE IN ELEMENTARY-SCHOOL SUPERVISION. I, II, S. 2 hr. PR: 6 graduate hours of elementary education, or consent. Observing and practicing major activities of the supervisor in work with pupils and teachers. To be taken late in student's candidacy.
- 327. DEMONSTRATION AND PRACTICE IN THE SUPERVISION OF SECONDARY-SCHOOL INSTRUCTION. I, II, S. 3 hr. PR: Consent. Observation and practice of approved methods and techniques in classroom supervision of instruction. To be taken late in student's candidacy.
- 328. PRACTICE ADMINISTRATION IN THE SECONDARY SCHOOL. I, II, S. 2 hr. PR: Consent. Internship study of school organization and administration.
- 331. PHILOSOPHY OF EDUCATION. I, II, S. 3 hr. A study of educational aims, values, and criteria of education in a democracy. Stresses different systems of educational philosophies, the nature of thinking applied to methods, and subject matter.
- 335. THE ELEMENTARY-SCHOOL CURRICULUM. I, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. An analysis of curriculum designs in elementary education with emphasis on methods and techniques of development.

336. **THE SECONDARY-SCHOOL CURRICULUM.** I, II, S. 3 hr. PR: High-school teaching experience, or consent. Emphasizes socio-economic and cultural influences on the curriculum; principles of curriculum development; curriculum building in the various teaching fields; techniques of experimentation and evaluation; and practice in curriculum building with special emphasis on unit construction.

337. **PROBLEMS IN ELEMENTARY AND SECONDARY-SCHOOL CURRICULUM.** I, II. 2 hr. PR: 8 hr. graduate education, including Ed. 336. Critical study of selected problems in curriculum with special emphasis on research.

338. **PROBLEMS IN THE SECONDARY SCHOOL.** I, II. 2 hr. PR: Consent. Culminating internship course for principals. Required research project designed to improve instruction and/or administration of the school.

339. **PUBLIC SCHOOL ORGANIZATION AND ADMINISTRATION.** I, S. 3 hr. PR: 20 hr. of education courses. Provides basic concepts through which administrators, supervisors, and teachers gain understanding of basic problems related to the operation of schools and school systems.

340. **PUBLIC-SCHOOL FINANCE.** II, S. 3 hr. PR or Conc.: Ed. 339 and consent. Sources of school support; taxation; efficient management of school money, improved budget practices and adequate apportionment plans. To be taken late in student's candidacy.

341. **SCHOOL BUILDINGS AND EQUIPMENT.** I, S. 2 hr. PR: or Conc.: Ed. 339 and consent. Philosophy, planning, and management of the school plant as an appropriate educational environment.

342. **PUBLIC EDUCATION AND THE LAW.** I, S. 3 hr. Legal permissives and limitations involved in setting policy for, organization of, and administration of public schools.

343. **SCHOOL SURVEYS.** I, II, S. 2 hr. PR or Conc.: Ed. 339 and consent. Development of the educational survey as an instrument for improving educational procedures.

344. **STAFF-PERSONNEL ADMINISTRATION.** S. 2 hr. PR or Conc.: Ed. 339, consent. Selection, induction, direction, evaluation, improvement, and promotion of members of the administrative, supervisory, instructional, research, clerical, and maintenance staffs.

345. **SEMINAR IN EDUCATIONAL LEADERSHIP.** I, II, S. 2-8 hr. PR: Consent. An integrated study of the problems of school leaders in the areas of administration, supervision, and instruction.

346. **PRINCIPLES OF SUPERVISION.** I, II, S. 3 hr. PR: Consent. Basic, general principles of elementary-school, junior high-school, and senior high-school supervision.

348. **HUMAN DEVELOPMENT AND BEHAVIOR.** I, II, S. 3 hr. A study of the inter-relationship of physical and environmental factors as these affect behavior of children and youth.

349. **PSYCHOLOGICAL FOUNDATIONS OF LEARNING.** I, II, S. 3 hr. A study of the psychological and philosophical foundations of major learning theories.

350. **INTER-DISCIPLINARY SEMINAR FOR SCHOOL ADMINISTRATORS.** I, II. 6 hr. PR: Consent. A study of the academic disciplines pertinent to school administration.

351. **COMMUNICATIONS AND NEW EDUCATIONAL MEDIA.** I, S. 3 hr. The psychological implications of communications media in learning and teaching. Attention to educational television, programmed instruction, cross-media, techniques, and experimental and developmental programs.

353. **THE SECONDARY-SCHOOL PRINCIPAL.** S. 3 hr. PR: Ed. 339 and high-school teaching experience, or consent. Open only to graduate students in Education, late in candidacy. Practicum in secondary-school administration.

356. ELEMENTARY-SCHOOL PRINCIPAL. S. 3 hr. PR: 6 graduate hours of elementary education, or consent. A study of the function of administration and supervision in the modern elementary school, emphasizing the role of the principal as an instructional leader. Designed particularly for persons preparing for administrative and supervisory positions (to be taken late in candidacy.)

360. PROBLEM IN EDUCATION. I, II, S. 3 hr. Research for Master's degree in Education, option B.

361. THESIS IN EDUCATION. I, II, S. 6 hr. Research for Master degree in Education, option A.

362. PROJECT IN EDUCATION. I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Education.

363. DISSERTATION. I, II, S. 6 hr. per sem. Research for the Doctor of Education degree.

364. ADVANCED METHODS IN TEACHING INDUSTRIAL EDUCATION. II, S. 3 hr. PR: Ed. 194 or consent. Trends in Industrial Education reflecting modern teaching methods; classroom representation of industrial methods; effective use of the newer instructional media.

365. CURRICULUM CONSTRUCTION IN INDUSTRIAL ARTS. S. 3 hr. PR: Consent. Techniques used in building curriculum designs in industrial arts.

367. SOCIAL STUDIES IN SECONDARY SCHOOLS. I, S. 3 hr. PR: Consent. Nature and function of social studies in the secondary school; utilization of community, state, national, and world resources in teaching; selection of content for teaching purposes; curriculum construction with emphasis on resource and teaching units.

370. PRINCIPLES OF INSTRUCTION. I, II, S. 3 hr. PR: Consent. Emphasizes the basic principles of teaching-learning process implied in major learning theories; study of factors in learning such as problem solving, competencies needed by teacher; improving techniques common to traditional and modern methods of instruction.

372. STATISTICAL ANALYSIS IN EDUCATION. I, II, S. 3 hr. PR: Ed. 271 or consent. Review measures of central tendency, percentiles, and correlation. Emphasis placed on correlation, regression, testing hypothesis, non-parametric tests, and other measures in analysis and inference.

380, 381, 382, 383. PRACTICE IN SUPERVISION. I, II. Credit: 2 hr. ea. PR: Assignment to actual full-time work in supervision in a school system, previous certification, and consent. Each course a continuation of the preceding. To complete the entire 8 hours, not less than two full years of field experience will be accepted.

385. HISTORICAL AND SOCIOLOGICAL FOUNDATIONS OF AMERICAN EDUCATION. I, II, S. 3 hr. A study of the development of American education. Emphasis placed upon movements and leaders.

395, 396, 397, 398. PRACTICUM. I, II, S. 2-4 hr. per sem. or term—aggregating not more than 12 hr. PR: 8 graduate hr. in Education. Enrollment with permission of adviser or instructor in consultation. Special individual and group projects. To provide appropriate residence credits for special workshops, prolonged systematic conferences on problems and projects in Education. Credits in these projects cannot be substituted for required courses.

399. SEMINAR IN EDUCATIONAL RESEARCH. II. 2 hr. PR: Ed. 301 and consent. Application of research methods and techniques to problems in modern education; analysis and implications of results.

Division of Family Resources

(formerly Home Economics)

The Division of Family Resources offers work leading to the degrees of Master of Science in Home Economics Education, Master of Home Economics, Master of Science in Home Economics with a Major in Child Development, and Master of Science in Home Economics with a Major in Human Nutrition.

All candidates for graduate degrees must conform to the general regulations of the Graduate School and the rules of the Division of Family Resources. The Graduate Record Examination will be administered by the Graduate School to all students majoring in the Division. After acceptance in the Graduate School, applications will be reviewed by the Graduate Admissions Committee of the Division. At that time, an applicant will be notified of acceptance, conditional acceptance, or rejection for graduate study in the Division. A student must maintain a 3.0 grade-point average in course work taken within the Division in order to be awarded the master's degree from the Division of Family Resources. Additional detailed information may be obtained by writing the Director of the Division.

Teaching assistantships are available at \$1,800 for 9 months, half-time service and tuition exempt.

THE DEGREE OF MASTER OF SCIENCE IN HOME ECONOMICS EDUCATION

Candidates for the Master's Degree in Home Economics Education must have fulfilled the requirements for a B.S.H.E. Degree at West Virginia University or at an approved college offering an equivalent degree. In addition, the candidate must have completed a minimum of 14 hours in Education and 36 hours in Home Economics as an undergraduate.

The required curriculum leading to the Degree of Master of Science in Home Economics Education is as follows:

<i>Option A:</i>	<i>Hr.</i>	<i>Option B:</i>	<i>Hr.</i>
Family Resources	10-20	Family Resources	10-20
Education	10-20	Education	10-20
Thesis	6	Problem	3
Allied Fields	0-10	Allied Fields	0-10
TOTAL	30	TOTAL	30

<i>Option C:</i>	<i>Hr.</i>
Family Resources	10-20
Education	10-20
A minimum of work outside the field of education	10
TOTAL	36

Those electing to obtain the Master's Degree by Option C shall be required to take comprehensive written examinations. These examinations shall be furnished by:

1. Each of two or three staff members in the major area. Each examination will require approximately two hours to answer (a total of 4 to 6 hours).
2. Each of two members of the staff in minor fields. These examinations will require one and one-half hours to answer (a total of 3 hours).

Any candidate undertaking to write a problem report or a thesis must enroll in Home Ec. Educ. 309. Candidates enrolling for courses offered through the West Virginia University Extension Division shall do so on the basis of having obtained prior written approval from the adviser. Whenever a candidate elects work in another institution with the expectation of transferring the credit to West Virginia University, the candidate shall do so only with the approval of the adviser and the Dean of the Graduate School and previous to undertaking such work. A minimum of 6 hours shall be taken in courses open to graduate students only; that is, courses in the 300 series. These shall be in addition to Ed. 360 or Ed. 361.

THE DEGREE OF MASTER OF HOME ECONOMICS

Candidates for the degree of Master of Home Economics shall have previously completed the requirements for a Bachelor of Science in Home Economics or Bachelor of Arts with a major in Home Economics at West Virginia University or at an approved institution offering such a degree.

The curriculum is planned to meet the needs of those who wish training beyond the bachelor's degree in order to be better qualified for professional work. It provides for breadth of training rather than for specialization in a narrow subject-matter area.

To insure breadth of training, students enrolled in this curriculum shall take work in at least five subject-matter areas in home economics, with a maximum of 10 credit hours in any one field. A maximum of 10 credit hours may be taken in other colleges at the University.

The student shall plan work in advance with the help of the adviser, selecting courses which will help her perform better the work which she plans to do. Prior approval must be obtained from the adviser for all courses offered in fulfillment of degree requirements, whether they be taken in residence or by extension.

For the Master of Home Economics degree the subject-matter fields shall be those listed in the *Undergraduate Catalog*. At present these fields are: food and nutrition, textiles and clothing, housing and design, child development and family relations, home management and family economics, and home economics education.

A research thesis will not be required but a problem report on some phase of Home Economics will be required. Not more than 3 hours of credit may be allowed for the problem report which must be approved by the student's committee. The report must be submitted in the form prescribed by Graduate School regulations.

Special requirements may be made by the Division of Family Resources and approved by the Dean of the Graduate School.

THE DEGREE OF MASTER OF SCIENCE IN HOME ECONOMICS WITH A MAJOR IN CHILD DEVELOPMENT

This program is designed to permit students to do advanced study and original research in the field of child development.

To enter this program the student must have a baccalaureate degree from an approved institution with sufficient background in child development, family life, psychology and education to qualify for admission to graduate courses in these areas.

The satisfactory completion of a minimum of 30 credit hours of graduate work approved by the adviser is required. These shall include at least 6 hours, exclusive of research, to be taken in 300 level courses. No more than 6 research credits may be applied to the minimum credit requirements. The required curriculum shall include:

Family Resources	10-15 hr.
Courses in Allied Fields	10-15 hr.
Cognate Courses	6-10 hr.

An acceptable written thesis based upon individual research and the approval of an examining committee following an oral examination on the thesis shall be required before the candidate is recommended for the degree.

THE DEGREE OF MASTER OF SCIENCE IN HOME ECONOMICS WITH A MAJOR IN HUMAN NUTRITION

The students who seek the degree of Master of Science in Home Economics with a major in Human Nutrition must have received the baccalaureate degree from an approved institution. They should have sufficient background in nutrition, chemistry, biochemistry, and physiology to qualify for admission to graduate courses in these areas.

The satisfactory completion of a minimum of 30 credit hours of graduate work approved by the adviser is required. At least 6 credit hours shall be in courses at the 300 level. No more than 6 hours credit in research may be applied to the minimum credit requirement. The required curriculum shall include the following courses:

Family Resources	10-15 hr. (major field)
Allied Sciences	10-15 hr. (minor field)
Electives in Supporting Fields	6-10 hr.

A written comprehensive examination planned by the examining committee of at least three faculty members representing the major and minor areas of concentration, the presentation of an acceptable written thesis based upon individual research and the approval of the thesis following an oral examination by the examining committee will be required before the degree is granted.

FOOD AND NUTRITION

201. DIET THERAPY. II. 3 hr. PR: FN 241, Zool. 271 or consent. Adaptations of normal diet for disease whose prevention or treatment is largely influenced by diet. Offered in alternate odd years.
205. EXPERIMENTAL COOKERY. II. 3 hr. PR: FN 15, Chem. 313, (1 hr. lec., two 2-hr. labs.). Utensils, ingredients, temperature, manipulation, and cooking methods as they affect quality of cooked products. Offered in alternate odd years.
211. READINGS IN NUTRITION. II. S. 1-4 hr. PR: FN 241 or consent. Review of current literature and of present research. Topics depend upon needs and interests of class members.
221. FAMILY AND COMMUNITY NUTRITION. II, S. 3 hr. PR: Consent. Special emphasis is given to nutritional status of the individual and family in the community. Students study nutritional problems and work toward their solutions through fieldwork.
241. HUMAN NUTRITION. I. 3 hr. PR: One course in Nutrition, Physiology, or Biochemistry or consent. (2 lec., 1 lab.). The role of food nutrients in the physiological and biochemical processes of the body; nutritional needs of healthy individuals under ordinary conditions and in periods of physiologic stress. Offered in alternate even years.
281. PROBLEMS IN NUTRITION AND/OR DIET THERAPY. 1-4. PR. Consent.
285. PROBLEMS IN FOODS. 1-4 hr. PR: Consent.
288. PROBLEMS IN INSTITUTION MANAGEMENT. 1-4 hr. PR: Consent.
301. GRADUATE NUTRITION SEMINAR. 1-4 hr. PR: FN 241 and consent. Review and discussion of recent progress in foods and nutrition research.
361. NUTRITION RESEARCH. 1-6 hr. PR: FN 241, Chem. 5 or 106 or consent. Research in foods and/or nutrition.

TEXTILES AND CLOTHING

212. ADVANCED CLOTHING CONSTRUCTION. II. 2 hr. PR: TC 232 or consent. Offers opportunity for creative expression and for understanding of pattern design through handling of fabrics on dress form. Costumes are designed, draped, and constructed.
217. TEXTILES FOR CONSUMERS. I. 3 hr. PR: TC 17. Regulation, marketing channels, information sources, and new developments relevant to the selection of fabrics for household uses and wearing apparel.
222. TAILORING. II. 3 hr. PR: TC 2, 17. Tailoring of suits and coats. Emphasis placed on professional techniques, advanced fitting, and construction of garments. Second garment constructed by fast method techniques.
232. COSTUME DESIGN. I. 2 hr. PR: TC 2, 217. Techniques of figure and fashion drawing. Designing for individuals of various types and ages. Some history of costume included.
282. PROBLEMS IN CLOTHING. 1-4 hr. PR: Consent.
287. PROBLEMS IN TEXTILES. 1-4 hr. PR: Consent.

HOUSING AND DESIGN

- 223. ADVANCED INTERIOR DESIGN. 3 hr. PH: HD 23, 123, or consent. A study of the technical and design information necessary to comprehend and function within the contemporary home furnishings market. Offered alternate years.
- 283. PROBLEMS IN HOUSING AND/OR DESIGN. 1-4 hr. PR: Consent.

CHILD DEVELOPMENT AND FAMILY RELATIONS

- 224. FAMILY AND THE INDIVIDUAL IN THE COMMUNITY. I, S. 3 hr. PR: One course in the family, or sociology, or consent. Social psychological analysis of the individual in the family and in other social systems. Involves the study of role relationships, community processes, and attitudes and values as they affect the behavior of the individual.
- 264. FAMILY DEVELOPMENT. I, II, S. 3 hr. PR: CDFR 114 or consent. A professional course designed to prepare students for work with families in their varying stages of development and different socio-economics levels. Involves intensive study of family relationships as affected by differing stages of the family life cycle, from the beginning family through the aging couple. Lecture, discussion, and observation of families.
- 266. NEEDS OF ADOLESCENTS. I, II. 3 hr. A study of adolescent needs as met by the home with contributions of other agencies such as church, school and youth groups. Physical, social, and integrative needs will be considered from the standpoint of needs of all family members as well as the individual.
- 276. SEMINAR IN CHILD DEVELOPMENT. I, II. 2 hr. PR: Senior standing and consent. A review and discussion of recent literature pertaining to child development.
- 284. PROBLEMS IN FAMILY RELATIONS. 1-4 hr. PR: Consent.
- 286. PROBLEMS IN CHILD DEVELOPMENT. 1-4 hr. PR: Consent.
- 304. SEMINAR. 2 hr. PR: CDFR 114, CDFR 264, consent. An examination of research procedures used in the study of family relationships and a critical examination of current research in this area.
- 376. THESIS IN CHILD DEVELOPMENT. 1-6 hr. PR: HEEd. 309 and consent. Thesis for the degree of Master of Science.

HOME MANAGEMENT AND FAMILY ECONOMICS

- 210. FAMILY ECONOMICS. I, II. 3 hr. PR: Senior or graduate standing. Management of the family's money resources. Consideration of the economic problems of families, of planned spending and saving, and of the role of the consumer.
- 220. CONSUMER ECONOMICS. I. 3 hr. PR: Econ. 51, HMFE 210 (214), or consent. Course designed to help students understand the place and role of consumers in our economy. Involves the study of research methods and techniques being used to identify, understand, and solve consumer problems.
- 230. HOME MANAGEMENT, PRINCIPLES AND APPLICATION. I, II. 3 hr. PR: Upper-division standing. Study and application of management in a variety of situations faced by the family with opportunity to integrate knowledge from other courses.
- 250. HOUSEHOLD EQUIPMENT. I, II. 2 hr. Selection, arrangement, use and care of equipment for various situations and for different income levels. Laboratory and discussion.
- 280. PROBLEMS IN HOME MANAGEMENT AND/OR FAMILY ECONOMICS. 1-4 hr. PR: Consent.

HOME ECONOMICS EDUCATION

209. EVALUATION IN HOME ECONOMICS. II. 3 hr. PR: 30 hr. of Home Economics, 7 hr. of Education. Experience in selecting, devising, and using evaluation devices for appraising progress toward desired goals in Home Economics Education. Offered alternate odd years.

219. ADULT EDUCATION IN HOMEMAKING. I. 3 hr. PR: 30 hr. of Home Economics, and 7 hr. of Education. Current trends and present activities. Organization of adult classes; development of unit outlines; consideration of teaching methods; illustrative material and bibliography. Offered in alternate even years.

279. SEMINAR IN HOME ECONOMICS EDUCATION. II, S. 3 hr. PR: Senior standing and 6 hr. of Education. A review and discussion of recent literature pertaining to home economics at the junior and senior high school levels and the college and adult levels based on the history of the home economics movement from the Lake Placid Conference in 1909 to the present time.

309. RESEARCH METHODS. I. 2 hr. Adaptations of research techniques to problems in home economics. For students writing thesis, problem, or research report.

319. HOME ECONOMICS CURRICULUM. 3 hr. PR: Experience in teaching home economics and consent. Selection and organization of learning experiences in home economics. Practices and techniques currently used for curriculum planning and construction.

329. SUPERVISION IN HOME ECONOMICS. 2 hr. PR: Teaching experience and consent. Designed for home economics teachers preparing to serve as supervising teachers in off-campus training centers. Function of supervision and organization of supervised teaching program. Techniques for helping students in training for teaching home economics.

360. PROBLEM REPORT FOR THE DEGREE OF MASTER OF HOME ECONOMICS. 1-3 hr. PR: HEEd. 309.

389. PROBLEMS IN HOME ECONOMICS EDUCATION. 1-4 hr. PR: Consent.

Division of Social Work

The professional curriculum in social work is on the graduate level and leads to the Master of Social Work degree. The program is accredited by the Council on Social Work Education.

The work toward this degree requires two years of academic residence, beginning in the fall semester of the academic year, and includes the summer session between the two regular academic years. Students may be admitted to the second year of the program after the satisfactory completion of one year of comparable social work education, if they meet the general requirements for admission to the graduate program.

The curriculum is based on the conviction that there are common elements in all social work and that the student who receives the degree will be prepared to practice in almost any areas of social work. The concentration on courses in social casework provides the student with the knowledge required for beginning competence in his method.

FIELD WORK

The two-year graduate curriculum includes alternating periods of study on campus and field instruction in social agencies and is required of all candidates for the Master's degree. It is provided jointly by the University and selected cooperating agencies. The faculty of the Division maintains close contact with each student and agency during the blocks of field instruction.

Placements are made in a wide variety of social welfare agencies and programs in West Virginia and nearby states and are usually in two agencies with somewhat different programs. First-year placements are for four months and second-year placements for six months.

SCHOLARSHIPS AND EDUCATIONAL STIPENDS

A number of scholarships, traineeships, and educational stipends are available for graduate social work students, ranging in value from \$150 to \$3,000 per year. Inquiries concerning these should be made to the Chairman of the Admission Committee, Division of Social Work.

ADMISSION REQUIREMENTS FOR THE PROFESSIONAL PROGRAM

Students are admitted for graduate study in the Division of Social Work who meet all of the following requirements:

1. Graduation with a bachelor's degree from any accredited college or university.
2. Proof of superior academic capacity and achievement (the Graduate Record Examination will be required of all those accepted for graduate training and may be required as a prerequisite to the consideration of any application for admission.)
3. Approval by the Committee on Admissions of the Division based on the above, and on satisfactory evidence of personal characteristics which give promise of success in the profession of social work.

REQUIREMENTS FOR THE DEGREE OF MASTER OF SOCIAL WORK

The degree of Master of Social Work is conferred by the University upon those students who satisfactorily complete the requirements as established by the Graduate School. These requirements are:

1. Completion of graduate courses approved by the Division of Social Work totaling not fewer than 54 semester hours, of which the last 30 hours shall have been completed in West Virginia University.
2. Completion of a field instruction program approved by the Division of Social Work.
3. Completion of Problem report.
4. Demonstration of competence in the theory and practice of social work to the satisfaction of the faculty of the Division. This will include passing a comprehensive examination at the end of the first year of graduate work and proof of competence for professional practice before the end of the second year of study.

The degree will not be awarded solely for credits earned.

SOCIAL WORK

General Prerequisites. Twelve semester hours in the behavioral sciences are required for admission to social work courses in the 200 series. The 300 series courses are designed as an integrated program for students who are working toward the M.S.W. degree. These courses are open to other students by consent and as required in their curricula.

212. INTRODUCTION TO SOCIAL WELFARE. I. 3 hr. A general introduction to social welfare in the United States. History, philosophy, programs and problems. Social welfare as a social institution. The American way in welfare. The emphasis is on what the citizen needs to know about welfare problems and solutions.
213. THE FIELD OF SOCIAL WORK. 3 hr. PR: S.W. 212. A critical analysis of theory and practice in major areas of welfare, including public assistance, the care of dependent children, mental health and service for the aged.
215. THE PROFESSION OF SOCIAL WORK. II. 3 hr. PR: S.W. 212. Social work as a professional service; its place in society; its purpose, underlying values, knowledge, and methods.
301. SOCIAL CASEWORK I. I. 3 hr. Emphasis is placed on understanding the problems involved in asking for, using, and relinquishing help; on interviewing and recording; and on securing familiarity with services, policies and procedures of typical social agencies. Discussion is based on case records and readings in professional literature.

302. SOCIAL CASEWORK II. II. 3 hr. Continuation of S.W. 301. Application of generic casework principles and concepts, drawing upon the student's field work experience and additional case materials from various settings.

303. SOCIAL CASEWORK III. II. 3 hr. Analysis of case situations of increasing complexity involving deviate and normal behavior. Case materials drawn from medical, psychiatric, authoritative, child welfare and family service settings are used to develop the relationship of theory to practice in varied settings and the relationship of the caseworker to other disciplines.

306. SOCIAL WELFARE POLICY AND SERVICES I. I. 2 hr. Study and appraisal of welfare policy and agency program, public and voluntary. The student is expected to develop beginning skill in analyzing and assessing welfare policy, programs, problems, and professional role.

307. SOCIAL WELFARE POLICY AND SERVICES II. II. 2 hr. Continuation of S.W. 306.

308. SOCIAL WORK POLICY AND SERVICES III. II. 3 hr. More intensive critical assessment of social welfare policy and services, with special reference to selected current issues and value assumptions.

311. 312. FIELD INSTRUCTION. I, II, S. 5 hr. each. Field instruction and practice in selected agencies under general direction of the faculty and under direct supervision of an agency supervisor or faculty member.

314. FIELD INSTRUCTION. I, II. 1-4 hr. Field instruction and practices in a selected agency, under general direction of the faculty. Supplements S.W. 311 and 312.

318. INTRODUCTION TO COMMUNITY ORGANIZATION METHOD II. 2 hr. A general introduction to the process of community organization in social work practice. How communities identify needs and develop resources for social welfare.

320. GROWTH AND BEHAVIOR I. I. 4 hr. Man as a psychosocial, biological entity. Normal physical, psychological and social development. Theories of personality structure and dynamics. The mechanisms for maintaining social functioning under stress.

322. GROWTH AND BEHAVIOR II. II. 3 hr. Further study of the process of personality growth. Application of psychodynamic principles to the study of emotional and mental illness. Consideration of the major organic and functional disorders.

323. GROWTH AND BEHAVIOR III. II. 3 hr. An advanced course in the biological, psychological and social determinants of human behavior with emphasis on social functioning as the measure of adjustment.

331. 332. ADVANCED FIELD INSTRUCTION. I. 5 hr. each. Continuation of S.W. 311 and 312, usually in a different setting.

334. ADVANCED FIELD INSTRUCTION. I, II, S. 1-4 hr. Continuation of S.W. 311 and 312. Designed to supplement S.W. 331 and 332.

340. THE SCIENTIFIC FOUNDATIONS OF SOCIAL WORK. I. 3 hr. Theoretical and empirical bases of social work practice. The scientific approach to social welfare problems. Introduction to research methods.

341. PROBLEMS REPORT. I, II, S. 1-2 hr. per sem. or term. Total required: 3 hr. Substantial exploration of a professionally significant problem.

350. INTRODUCTION TO SOCIAL WORK WITH GROUPS. I. 1-2 hr. Principles and methods used by social workers to help individuals use group relationships for individual growth and improved social functioning. Concepts from small group theory are examined and integrated with concepts and principles of social work practice.

351. ADVANCED SOCIAL WORK WITH GROUPS. II, S. 2 hr. Continuation of S.W. 350. Integration of principles and methods drawn from social group work and social casework. Emphasis is placed on the use of the group as the medium for social work help in various settings. Concepts pertaining to family group and

multiple-client interviewing are examined as well as work with primary and formed groups.

360. SEMINAR. II. 2 hr. Intensive study in student's area of special interest. Individual conferences with staff; guided reading program; preparation of an individual written report. Seminar meetings for all students supplement individual study.

INSTITUTE OF BIOLOGICAL SCIENCES

The Institute of Biological Sciences, comprising the departments associated with the life sciences, offers advanced study and research on a disciplinary and interdisciplinary basis in areas of experimental biology ranging from the molecular to the population level. The staff of the institute includes a faculty of more than eighty Ph.D.'s encompassing nine departments located on the Downtown, Evansdale, and Medical Center campuses. Work toward the Ph.D. degree may be pursued in the basic botanical and zoological sciences, the agricultural sciences, or the medical sciences. All programs leading to the Ph.D. degree also offer the M.S. degree. There are a few additional programs which offer only the M.S. degree.

No rigid statement about academic requirements for graduate studies in the biological sciences can be made. Each department sets its own requirements, details of which should be obtained from the appropriate departmental chairman who are listed below along with the research activities of their departments. In general, students with good academic records and majoring in chemistry, biology, or the agricultural sciences are desirable applicants. All students should be adequately prepared in mathematics, biology, and chemistry, especially the latter. Potential graduate students are urged to take, during their senior year as an undergraduate, the Graduate Record Examination, both the aptitude and advanced tests. It is advisable to prepare for the foreign language requirements for the Ph.D. degree by taking undergraduate courses in two languages, preferably French and German.

A general application form may be obtained from The Director, Institute of Biological Sciences, Room 1157 Basic Sciences Building, West Virginia University Medical Center. Inquiries concerning individual programs, financial assistance, departmental requirements, and professional career opportunities should be sent to the appropriate departmental chairman as listed below.

BOTANICAL AND ZOOLOGICAL SCIENCES

Biology: Dr. Jay Barton, 200 Brooks Hall.

Research Areas—Cell Biology: The physiology and biochemistry of avian and mammalian germ cell. *Molecular Biology:* Effects of age and radiation on DNA, and other biopolymers. *Aquatic Biology:* Investigation of productivity of certain streams, and study of the ecology of algae. *Systematic Biology:* Taxonomic studies of the plant and animal life of the Appalachian region.

AGRICULTURAL SCIENCES

Agricultural Biochemistry: Dr. Homer Patrick, 1032 Agricultural Sciences Building. *Research Areas—Biochemistry:* carbohydrate chemistry; enzymes; mineral metabolism. *Radiochemistry:* gamma irradiation; genetics; radionuclide mineral metabolism; irradiation damage.

Agronomy and Genetics: Dr. G. Gordon Pohlman, 1008 Agricultural Sciences Building.

Crop Science: Field crop, forage and pasture production and management; crop rotation systems; cutting management, stand establishment and longevity of forages; weed control; low temperature hardiness, physiological effects of chemicals on crop plants and weeds. Genetics: Immunogenetics of protein polymorphism and their biochemical basis; biochemical genetics of enzyme polymorphism; physiological-biochemical basis of hereterosis; mechanisms of action of indole-acetic acid; molecular basis of development and differentiation; population genetics and inheritance of reproductive traits; radioprotective effect of alloxan and its mode of action; cytogenetic, cytotoxic and cytological studies in plants; freeze preservation of biological materials. Soil Science: Soil chemical properties and their interrelationships, characterization of soil phosphorus and organic nitrogen compounds; nutrient availability as related to soil structure; time and rate of potassium fertilization on crops; hydrology of watersheds on shale soils, factors relating to frost heaving, surface mine land reclamation; micronutrient availability; soil fertility; forest-soils relationships.

Animal and Veterinary Science: Dr. Marvin R. McClung, G-036 Agricultural Sciences Building.

Research Areas—Nutrition: Control of feed intake; nonprotein nitrogen metabolism; bacterial carbohydrate metabolism in ruminants. Physiology: Magnesium homeostasis; pituitary-ovarian relationships; dietary factors and thyroid function; sperm metabolism; breeding seasons and reproductive efficiency. Veterinary Pathology: Avian infectious synovitis; pathogenesis of uterine infection. Genetics and Breeding: Genetic and environmental factors in production of meat, milk and eggs; genetic effects of irradiation; evaluation of breeding systems. Food Science: Effects of environmental, genetic, and age differences on quality of meat, milk, and eggs.

Plant Pathology, Bacteriology, and Entomology: Dr. H. L. Barnett, 401 Brooks Hall.

Research Areas—Agricultural Bacteriology: Microbiology of streams and ponds; microbial decomposition in sanitary landfills; physiology of fungi; effects of light on fungi; mycoparasitism. Plant Pathology: Physiology of host-parasite relationships; late blight of potato and tomato; disease of field and forage crops; biology and control of plant parasitic nematodes; oak wilt; decay of hardwoods and wood products. Entomology: Insect pests of livestock; alfalfa weevil control; insect pests of forest plantations.

MEDICAL SCIENCES

Anatomy: Dr. Donald L. Kimmel, 4053 Basic Sciences Building, Medical Center.

Research Areas—Gross Anatomy: Anatomical variations and anomalies, and electromyographic studies of specific muscle groups. Microscopic Anatomy: Studies of cells, tissues and organs, under normal and experimental conditions with histochemical, electron microscopic, autoradiographic, regenerative, fluorescent techniques. Developmental Anatomy: Experimental and descriptive embryology, cellular differentiation, and dedifferentiation, organizers and the effects of different environments on development. Neuroanatomy: Experimental, comparative and embryological studies of specific nerve cell groups and nerve pathways in the spinal cord, brain stem, cerebellum and cerebrum.

Biochemistry: Dr. Reginald F. Krause, 3127 Basic Sciences Building, Medical Center.

Research Areas—Nutrition: Vitamin A and carotene metabolism. Enzymology: Enzyme kinetics. Biological Transport: Fatty acids and amino acids. Organic Synthesis of Biological Compound: "Sulfones." Immuno Chemistry: Complement factor, antigen-antibody reactions. Genetics: Biochemical defects in inherited diseases. Lipid Metabolism: Atherosclerotic disease and cardiac hypertrophy.

Microbiology: Dr. John M. Slack, 2078 Basic Sciences Building, Medical Center.

Research Areas—Immunology: Studies on the mechanisms of antigen-antibody reactions and the development of hypersensitivity. Virology: Characterization of respiratory viruses using tissue cultures and fluorescent antibody techniques. Parasitology: Host-parasite relationships between various protozoa and insect or animal hosts. Physiology: Nutrition and metabolism of a variety of pathogenic microorganisms. Genetics: Basic studies on the mechanisms of genetics including transformation of genetic information. Electron Microscopy: Cytological studies of the fine structures of microorganisms and the influence of environment on these structures.

Pharmacology: Dr. William W. Fleming, 3037 Basic Sciences Building, Medical Center.

Research Areas—Autonomic pharmacology: Smooth muscle pharmacology; supersensitivity to autonomic drugs; effects of drugs, stress, and other factors on catecholamine release and excretion. Cardio-vascular Pharmacology: Effects of anesthetics, antihypertensives, and other drugs on cardiac function. Endocrinology: Physiology of parathyroid gland function; endocrine aspects of calcium and bone metabolism. Parasitology: Effects of chemotherapeutic drugs on intestinal fauna and flora. Toxicology: Metabolism of toxic agents.

Physiology: Dr. Michael F. Wilson, 3055 Basic Sciences Building, Medical Center.

Research Areas—Enterogastrone and its derivatives in urine; effect of hypoxia and of exercise on experimental myocardial infarction, regression of experimental cardiac hypertrophy; cardiovascular influences on growth; osteoporosis of disease; hypoxia and hyperthyroidism on intestinal motility; role of the hypothalamus in locomotor activity; glycogen fractions of the heart; circadian rhythms in toxicity.

INTERDEPARTMENTAL PROGRAMS

Reproductive Physiology: Dr. E. K. Inskeep, G016 Agricultural Sciences Building. Research Areas—Physiology of spermatozoa; fertility and viability of aged ova; regulation of the life span and function of the corpus luteum; effects of light and other environmental factors on reproduction; physiology of uterine contractions; dietary mineral levels and reproduction; endocrinology and metabolism; role of gonadotropic hormones in control of steroidogenesis; control of estrus and ovulation and use of artificial insemination in beef cattle, swine and sheep; and physiology of intrauterine contraceptive devices. The members of the Faculty of Reproductive Physiology and their research facilities are located in various departments: Anatomy; Animal Science; Biology; Genetics; Internal Medicine; and Obstetrics and Gynecology.

Interdepartmental programs are being developed in the following areas:

Plant Physiology

Genetics

Bioengineering

Further information regarding these programs may be obtained from the Director, IBS, Room 1157, Basic Sciences Building, West Virginia University Medical Center, Morgantown, W. Va. 26506.

JOURNALISM

The School of Journalism offers work leading to the degree of Master of Science in Journalism.

Purpose of the Degree. The purpose of the degree is to provide the student who already has a sound background in technical and professional journalism education an opportunity to broaden his communications horizons by gaining a critical insight into the theory and practice of the communications industries; the degree also is intended to introduce the student to research methods applicable to communications problems.

Admission. In order to be admitted to the Master of Science in Journalism program, the student must have a baccalaureate degree in journalism from an accredited institution or must have completed a core program in journalism or must demonstrate competency in a minimum number of areas prescribed by the School of Journalism. The prospective student also must have a 3.0 average in undergraduate Journalism courses.

Requirements. The student will be required to meet the following requirements for the degree:

- a. Complete a minimum of 30 semester hours, including a thesis with a maximum of 6 hours credit.
- b. At least 18 hours of work, including the thesis, must be taken in the School of Journalism.
- c. A minor of 9-12 hours credit must be taken outside the School of Journalism.

Examination. On completion of course requirements, the candidate shall be required to pass an oral examination on his thesis and on his competence in his major and minor fields.

JOURNALISM

201. INTERPRETING CURRENT EVENTS. I, II, S. 1 hr. A study of national and world news developments, their backgrounds, and their meanings.
203. ADVERTISING MARKETS AND MEDIA. I, II, S. 3 hr. Advertising seniors must take Journ. 203, Journ. 204 or Journ. 210. Problems, functions, and responsibilities in communications media organization, operation, management, and promotion. Special emphasis on case-study of media management and promotion in the Appalachian area.
204. ADVERTISING MARKETS AND MEDIA. I, II, S. 3 hr. Advertising seniors must take Journ. 203, Journ. 204, or Journ. 210. A study of advertising planning, buying, and scheduling by advertisers, media, and advertising agencies on national and local levels. Seminar discussions and assignments with special emphasis on problems related to Appalachian markets and media.
210. ADVERTISING PRODUCTION. I, II, S. 3 hr. PR: Journ. 110. Advertising seniors must take Journ. 203, Journ. 204, or Journ. 210. A study and application of the processes and operations involved in carrying print advertising from the finished layout through production into print. Study includes the techniques of art production, advanced typography, and makeup. The student must acquire certain tools and supplies for laboratory work. Expense should not exceed \$15.00.
212. PUBLIC RELATIONS. I, II, S. 3 hr. Principles, problems, and practices concerned in the relationships of businesses, industries, and nonprofit organizations with their respective publics; practice in the evaluation of existing public relations programs; and their refinement for further effectiveness.
213. INDUSTRIAL JOURNALISM. II. 2 hr. PR: Journ. 212 or consent. A study of the relations between industry and its many publics, with emphasis on internal and external company publications as public relations media. Extensive practice in planning and writing material and in page makeup for industrial publications and trade journals.

215. HIGH SCHOOL JOURNALISM. II, S. 2 hr. A survey of scholastic publications problems and techniques; suggested methods of instruction.

220. NEWSPAPER AND MAGAZINE ARTICLE WRITING. II. 2 hr. A seminar-type course devoted to the writing, editing, and marketing of features, including reviews and critical articles; some emphasis on science writing.

227. HISTORY OF JOURNALISM. I, S. 3 hr. PR: Hist. 52, 53 or consent. A study of the impact of the American press on the nation; the development of today's communications media from their beginnings in 17th Century England and in the American colonies; and examination of the great names in journalism from the standpoint of their contributions to today's journalism; freedom of the press and its current implications.

228. LAW OF THE NEWS MEDIA. II. 3 hr. For senior and graduate students. Study of the law as it affects the mass media. Considered will be such areas as libel, public records, criminal trial publicity, freedom of information, pornography.

230. EDITORIAL AND INTERPRETIVE ARTICLE WRITING. I, II. 3 hr. Writing and analyzing editorials, columns and interpretive news articles, and editorial ethics, problems and policies. Open to all University juniors and seniors; required in News-Editorial and Public Relations curricula.

239. SEMINAR IN ADVERTISING-MANAGEMENT PROBLEMS. I, II. 2 hr. PR: Major or minor in advertising. Current trends in advertising, merchandising, and distribution problems. Students develop individual projects in some phase of advertising or management.

241. JOURNALISM PROBLEMS. I, II, S. 1-3 hr. For seniors and graduates. An intensive study, independently conducted, of a specialized area or problem in journalism, to be approved by the Dean.

242. ADVANCED JOURNALISM PROBLEMS. I, II, S. 1-3 hr. Continuation of Journ. 241.

243. INTERNATIONAL COMMUNICATIONS. I. 3 hr. International wire services. Coverage of world news in newspapers of the United States and foreign countries; and desirability of a free flow of information to and from the United States. United Nations efforts to lower news barriers will be examined.

281. PUBLIC AFFAIRS PROGRAMMING. I. 3 hr. PR: Television News or consent. The basic principles of evaluating and documenting public issues into television and radio presentation form. Includes methods of program selection, research, writing, sources and type of content materials.

282. PUBLIC AFFAIRS PROGRAMMING. II. 3 hr. PR: Public Affairs Programming. Continuation of above course. An in-depth laboratory course in actual preparation of materials for inclusion of public issues programs. Work includes filming and recording interviews, statements, background materials, obtaining and selecting supporting sound, music, art.

286. RADIO AND TELEVISION ADVERTISING. I. 3 hr. Open to all University students. Historical development of radio and TV as advertising media, including rates, listener survey, sponsorship problems, and promotion. Writing of radio and television commercials, programs, and preparation of sales and sales promotion plans for stations, national and retail advertisers. Federal regulations affecting broadcasting media.

301. RESEARCH METHODS AND LITERATURE I, S. 3 hr. A study of methods common to communications research; critical examination of communications literature; the mass media; problems of communicating with the various publics; general independent research project by each student.

302. SEMINAR IN COMMUNICATIONS THEORY. II, S 3 hr. Historical development of problems of contemporary mass media.

- 312. SEMINAR IN INSTITUTIONAL RELATIONS. II. 3 hr. A study of the problems of public relations and public information officers of educational institutions of higher learning and public service organizations; thorough study of the publics which these officers attempt to reach.
- 315. SEMINAR IN JOURNALISM EDUCATION. I, S. 1-3 hr. Discussion of journalism education problems. Each student will do an individual research project planned to provide for his professional development as a teacher of journalism. Emphasis on secondary school problems.
- 339. SEMINAR IN ADVANCED ADVERTISING MANAGEMENT PROBLEMS. II. 3 hr. Recently developed ideas and techniques in advertising, advertising research, and media management.
- 343. SEMINAR IN THE FOREIGN PRESS. II. 3 hr. Studies in legal and communications problems of the international flow of news and opinion; international press codes; communications media of major countries.
- 380. THESIS. I, II, S. 2-6 hr.
- 382. SEMINAR IN PUBLIC AFFAIRS BROADCASTING. I, II, S. 6 hr. Investigation and discussion of current problems and practices in the field of broadcast journalism. The student and the instructor will choose a problem, or a phase of a problem, for analysis and research as the course progresses.

MEDICAL CENTER

The Departments of Anatomy, Biochemistry, Microbiology, Pharmacology, and Physiology each offer programs of study leading to the Master of Science and the Doctor of Philosophy degrees. Admission to these program is permitted only with approval of the department concerned. Students should contact the chairman of the major department and request permission to do graduate work well in advance of the time of registration.

REQUIREMENTS FOR ADMISSION TO GRADUATE STUDY IN THE MEDICAL CENTER

1. The student's undergraduate scholastic standing shall be a quality equivalent to that required for admission to the School of Medicine or School of Dentistry.
2. A transcript of the student's grades should be available to the major department at least six weeks before the beginning of the semester in which the student desires to start his graduate work. In addition, two letters of recommendation from professors in major and minor fields are desirable.
3. The students may be asked to appear in person.
4. The candidate must meet the admission requirements of the department in which he pursues his major study. Qualifying entrance examinations and/or the Graduate Record Examination may be required.
5. After acceptance and before registration, the student and his adviser shall formulate a schedule for the entire year.

STANDARDS FOR GRADUATE STUDY AND REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE

1. No credits are acceptable toward an advanced degree which are reported with a grade lower than "C." Certain departments require the student to maintain a "B" average or that two-thirds of the credits carry a grade of "B."
2. A minimum of 30 hours of related graduate courses shall be required. Twenty hours shall be in the major field which include 6 hours credit for a thesis.
3. An examination in the major and related fields shall be given before the student can qualify for his final oral examination.
4. A thesis is required and shall represent original research by the candidate for the degree.

REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE FOR STUDENTS ENROLLED IN THE SCHOOL OF MEDICINE OR DENTISTRY

1. Medical or Dental students shall fulfill the above requirements for admission and scholarship.
2. Students enrolled in the Schools of Medicine or Dentistry who hold a Bachelor's degree from an approved institution and desire to do additional work for the Master's degree must also register in the Graduate School.
3. Medical and dental students may count preclinical courses in basic sciences toward the Master's degree as long as they complete not fewer than 24 semester hours of graduate courses that are not required for the degree of Doctor of Medicine or Doctor of Dental Surgery.
4. All courses offered to meet these requirements must be courses numbered between 200 and 399 that are approved by the Graduate School and listed in this bulletin.
5. A thesis is required.

REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREE

1. The student must meet the standards of scholarship required for the Master's degree and complete or offer previous graduate credit of no less than 60 semester hours of related course work, exclusive of research or thesis. However, these 60 semester hours may include 6 hours of research or thesis credit earned for the Master's degree.

2. The residence requirements set by the Graduate School for the degree of Doctor of Philosophy must be met.

3. Students will be required to take a comprehensive preliminary or qualifying examination, language examinations, and a final examination as specified by the regulations of the Graduate School. Arrangements must be made with the major department which will determine the scope and nature (either oral or written or both) of these examinations. Also, the major department may request the Dean of the Graduate School to approve the substitution for French or German a more suitable foreign language.

4. Before admission to the final examination, the candidate must submit a thesis that presents the results of the candidate's individual investigation, demonstrates a mastery of research techniques, and represents a definite contribution to knowledge.

REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE FOR STUDENTS WHO ARE DOCTORS OF MEDICINE OR DENTAL SURGERY

1. Such students must meet the standards of scholarship required for the Master's degree and complete not less than 30 semester hours of course work, exclusive of research or thesis, beyond that required for the professional degree.

2. The requirements, cited for the Doctor of Philosophy Degree, concerning examinations and thesis must be met.

MEDICAL CENTER COURSES OPEN TO GRADUATE STUDENTS ANATOMY

201. **GROSS ANATOMY.** (With Medical Students). I and II. 12 hr. PR: General zoology and consent. A detailed study of the human body with a complete dissection.
203. **NEUROANATOMY.** (With Medical Students). II. 5 hr. PR: General zoology and consent. A gross and microscopic study of the central nervous system.
205. **MICROANATOMY AND ORGANOLOGY.** (With Medical Students). I. 6 hr. PR: General zoology and consent. Structure, function, and embryology of tissues and organs.
206. **GROSS ANATOMY.** (With Dental Students). I and II. 8 hr. PR: General zoology and consent. A study of the human body including dissection.
208. **NEUROANATOMY.** (With Dental Students). II. 2 hr. PR: General zoology and consent. A gross and microscopic study of the central nervous system.
209. **MICROANATOMY AND ORGANOLOGY.** (With Dental Students). II. 6 hr. PR: General zoology and consent. Structure, function, and embryology of tissues and organs with emphasis on teeth and supporting structures.
301. **ADVANCED GROSS ANATOMY.** I, II, S. 2-6 hr. per sem. PR: Anat. 201 and consent. A morphological and functional analysis of selected regions. With dissection.
302. **ADVANCED DEVELOPMENT ANATOMY.** I, II, S. 2-6 hr. per sem. PR: Anat. 201 and consent. Detailed developmental anatomy of the fetal period and childhood. With dissections and analysis of variations and malformations.
303. **SEMINAR IN ANATOMY.** I, II, S. 1-6 hr. PR: Consent. Presentation and discussion of special topics of current or historical interest.
304. **APPLIED ANATOMY.** I, II. 2-6 hr. per sem. PR: Consent. Detailed study of anatomy adapted to the needs of the advanced student.
305. **EXPERIMENTAL EMBRYOLOGY.** II. 3 hr. PR: Embryology and cellular physiology or biochemistry and consent. An analysis of development, differentiation, and regeneration.
306. **ADVANCED NEUROANATOMY.** I. 2-4 hr. per sem. PR: Anat. 203 and consent. A detailed study of selected areas of the brain and spinal cord. Offered in 1967-68 and alternate years.

307. ADVANCED STUDY OF THE AUTONOMIC NERVOUS SYSTEM. I. 4 hr. PR: Anat. 203 and consent. Special topics on the peripheral autonomic nervous system and central areas of integration. Offered in 1968-69 and alternate years.

351. ADVANCED MICROANATOMY AND ORGANOLOGY. I, II, S. 2 hr. PR: Microanat. 205 or 209 and consent. An extension of the major topics included in Microanat. 205 or 209 with special emphasis on recent contributions.

397. RESEARCH IN ANATOMY. I, II, S. 1-15 hr. PR: Anat. 201, 203 and 205 or 209 and consent. Course may be repeated as needed with the consent of the Graduate Committee.

BIOCHEMISTRY

231. BIOCHEMISTRY. (With Medical Students). I. 7 hr. PR: Organic Chem., consent. A study of the chemical and physiochemical processes which take place in the human body.

232. BIOCHEMISTRY. (With Medical Students). II. 2 hr. PR: Biochem. 231 and consent. A continuation of Biochem. 231.

237. SEMINAR IN BIOCHEMISTRY. I, II, S. 1-6 hr. (1 hr. per sem.) PR: Biochem. 231, consent. Presentation and discussion of special topics.

239. CLINICAL CHEMICAL TECHNIQUES. (Primarily for Medical Technology Students). II. 4 hr. PR: Biochem. 231. Open to other qualified students.

323. BIOCHEMISTRY OF THE IMMUNE GLOBULINS AND RELATED PROTEINS. I. 2 hr. PR: Biochemistry. A study of the biosynthesis, chemistry, and biological properties of proteins important in immunology. Offered in 1968-69 and alternate years.

330. BIOCHEMICAL PREPARATIONS. I, II, S. 2-5 hr. PR: Biochem. 231 or equiv., consent. Emphasis on biochemical methods.

331. RADIobiOLOGY. II. 3 hr. PR: Biochem. 231 or equiv., consent. Emphasis on nature and measurement of isotopes and their biological applications.

332. ENZYME KINETICS. II. 3 hr. PR: Biochem. 231 or equiv., consent. An introduction to the physical mechanisms of enzyme action.

334. SPECIAL TOPICS. I, II, S. 1-18 hr. PR: Consent.

337. BIOCHEMISTRY OF THE AMINO ACIDS AND PROTEINS. I. 3 hr. PR: Biochem. 231 or equiv., consent. Offered in 1968-69 and every third year.

338. BIOCHEMISTRY OF THE LIPIDS. II. 3 hr. PR: Biochem. 231 or equiv., consent. Offered in 1967-68 and every third year.

397. RESEARCH IN BIOCHEMISTRY. I, II, S. 1-15 hr.

MEDICINE

223. HISTORY OF MEDICINE. (With Medical Students). I. 1 hr. A brief history of the development of the art and science of medicine.

MICROBIOLOGY

220. MICROBIOLOGY. (For Pharmacy Students and Graduate Students). II. 5 hr. PR or Conc: Organic Chem. A detailed study of pathogenic microorganisms.

221. MICROBIOLOGY. (For Medical Students, Second Year and Graduate Students). I. 7 hr. PR: Organic Chem., Biochem. A detailed study of pathogenic microorganisms.

222. PARASITOLOGY. (For Medical Student, Second Year). II. 2 hr. PR: Consent. Introduction to animal organisms as human pathogens and vectors of disease.

224. PARASITOLOGY. (For Medical Technology Students and Graduate Students). II. 4 hr. PR: Consent. Study of the biology of animal parasites and their roles as agents and vectors of disease.

225. **MICROBIOLOGY.** (For Dental Students). I. 5 hr. PR: Organic Chem. A detailed study of pathogenic microorganisms.

226. **BASIC MICROBIOLOGY.** (For Graduate Students). I. 4 hr. PR: Organic Chem.; Biology recommended; consent. A detailed review of the major groups of microorganisms including morphology and physiology.

227. **SPECIAL PROBLEMS IN MICROBIOLOGY.** I, II, S. 1-6 hr. per sem. with a total of 24 hr. available. PR: Microbiol. 226 or equiv.

228. **DIAGNOSTIC OR DETERMINITIVE MICROBIOLOGY.** I, II, S. 1-6 hr. per sem. with a total of 24 hr. available. PR: Microbiol. 226 or equiv. Diagnostic procedures as aids to diagnosis of human diseases and methods for the identification of microorganisms.

319. **COMPARATIVE CYTOLOGY.** I. 4 hr. PR: Consent. Basic features in structure and function of animal, plant, and microbial cells. Classical and electron microscopical methods and techniques in cytology and cytochemistry.

320. **ELECTRON MICROSCOPY.** I, II. 2 hr. per sem. with a total of 8 hr. available. PR: Consent. Study of structure and function of microorganisms and physics of the electron microscope.

321. **BACTERIAL PHYSIOLOGY.** I. 3-4 hr. (lect. 3 hr. with lab. 4 hr.) PR: Microbiol. 226 or equiv.; Organic Chem.; Biochem. or Conc. Physiological studies on bacteria including nutrition, metabolic pathways, growth and death.

322. **MICROBIAL GENETICS.** II. 4 hr. PR: Microbiol. 226 or equiv., consent. This course describes microbial mutation and adaptation, bacterial gene transfer mechanisms, and cytoplasmic inheritance.

323. **IMMUNOLOGY.** II. 4 hr. PR: Microbiol. 226 or equiv. A thorough study of antigens, antibodies, and their reactions both in vitro and in vivo and including the hypersensitivity phenomenon.

324. **VIROLOGY.** II. 4 hr. PR: Microbiol. 226 or equiv. A comprehensive study of human, animal, and bacterial viruses.

325. **MEDICAL MYCOLOGY.** I. 3 hr. PR: Microbiol. 226 or equiv.; Mycology 203 and 330 are recommended. A study of the fungi which infect humans with the emphasis on isolation and identification.

326. **SEMINAR.** I, II, S. 1-6 hr. PR: Microbiol. 226 or equiv. This will include the history of microbiology.

397. **RESEARCH IN MICROBIOLOGY.** I, II, S. 1-15 hr. per sem. Students may enroll more than once. PR: Microbiol. 226 or equiv.

PATHOLOGY

228. **PATHOLOGY. (With Dental Students).** II. 4 hr. PR: Consent. Microscopic Anat. 209. A study of disease processes with emphasis upon fundamentals.

251. **GENERAL PATHOLOGY.** Yr. 17 hr. PR: Consent. Includes gross and microscopic studies with demonstrations. (Note: Appropriate materials in Clinical Pathology are integrated in Path. 251).

253. **ORAL PATHOLOGY.** I. 3 hr. A study of the etiology of the diseases of the teeth and their investing structures.

256. **ADVANCED PATHOLOGY.** I, II. 3 hr. PR: Consent, Path. 228. Microscopic and gross specimens from selected autopsies.

397. **RESEARCH.** I, II. 1-15 hr. PR: Consent.

PHARMACEUTICAL CHEMISTRY

- 272. ORGANIC PHARMACEUTICAL CHEMISTRY. I. 3 hr. PR: Consent. A study of synthetic drugs and certain natural drug products, with regard to nomenclature, synthesis and therapeutic, physical and chemical properties.
- 273. ORGANIC MEDICINAL CHEMISTRY. II. 3 hr. PR: Consent. A continuation of Ph.Ch. 272 with special attention given to structure-activity relationship.
- 274. PHARMACEUTICAL ANALYSIS. I. 3 hr. PR: Consent. Application of basic scientific principles to the quality control of drugs and dosage forms, with particular attention to newer analytical techniques.

PHARMACOGNOSY

- 240. PHARMACOGNOSY. II. 6 hr. PR: Consent. A study of drugs of biological origin, both plant and animal; their specific origins, methods of preparation, active constituents, and medicinal and pharmaceutical uses. Examples of the methods used in the isolation and study of such products are presented in the laboratory.

PHARMACOLOGY

- 260. PHARMACOLOGY. (For Dental Students). I. 5 hr. PR: Physiology. Chemistry, pharmacodynamics, toxicology, and therapeutic use of drugs.
- 261. FUNDAMENTALS OF PHARMACOLOGY. (For Pharmacy Students). I. 5 hr. PR: Physiology. Classification, pharmacodynamics, and toxicology of therapeutic agents.
- 262. PHARMACOLOGY. (For Medical Students, Second Year). II. 6 hr. PR: Physiology. Chemistry, pharmacodynamics, toxicology, and therapeutic use of drugs.
- 265. SEMINAR IN PHARMACOLOGY. I, II. 1 hr. per sem. PR: or conc: Pharmacol. 262 or graduate status in basic medical sciences.
- 360. SPECIAL TOPICS IN PHARMACOLOGY. I, II, S. 1-6 hr. per sem. Assigned study in pharmacodynamics, autonomic and cardiovascular pharmacology, chemotherapy, bioassay, and the biochemistry of drug action.
- 362. ADVANCED PHARMACOLOGY. I, II, S. 1-6 hr. per sem. PR: Pharmacol. 262 or equiv. Lectures and laboratory study in advanced phases of pharmacology; development of research techniques.
- 397. RESEARCH IN PHARMACOLOGY. I, II, S. 1-15 hr. per sem. PR: Pharmacol. 262 or equiv.

PHYSIOLOGY AND BIOPHYSICS

- 242. PRINCIPLES OF ENDOCRINE SYSTEM. I. 4 hr. PR: Consent. Lecture-conference analysis of recent literature: control systems, hormonal actions on molecular processes, with design and completion of laboratory experiment. 3 lect-conf., 1 lab.
- 243. FUNDAMENTALS OF PHYSIOLOGY. (For Dental and Graduate Students). I. 5 hr. PR: College physics, algebra, and chemistry. Study of basic principles which relate to human function, and the manner in which they were developed. 4 lect.-conf., 1 lab.
- 244. INTRODUCTION TO BIOPHYSICS. (Primarily for Biology and Pre-Professional Students). S. 3 hr. PR: Biol. or Zool. 2, College Algebra. Designed to provide introduction to: instrumentation, bioelectricity, physics of special senses, radiation biology. 2 lect., 1 lab-demonstr.
- 245. MEDICAL PHYSIOLOGY. (For Medical and Graduate Students). II. 6 hr. PR: Biochem. 231 or consent. Analysis of basic facts and concepts relating to cellular processes, organ systems and their control. Nerve-muscle function will be treated primarily in Physiol. 246. 4 lect.-conf., 2 project-type lab.

246. **NEUROPHYSIOLOGY.** (For Medical and Graduate Students). II. 3 hr. PR: College algebra, physics. Properties of excitable tissues (nerve and muscle), synaptic transmission, reflexes and central nervous system function, and behavior. 2 lect., 1 lab.

340. **SPECIAL TOPICS.** I, II, S. 1-12 hr. PR: Consent. Assigned study designed to develop research skills.

341. **PHYSIOLOGICAL METHODS.** I, II. 4 hr. PR: Grad. Physiol. and E.E. 210 or equiv. Theory and application of techniques essential to acquisition and processing of physiological data. 2 lect., 2 conf.-lab.

342. **ADVANCED PHYSIOLOGY.** I, II, S. 1-6 hr. per sem. PR: Math. 116 (Calculus II) and Grad. Physiol. Lecture-seminar in physiological and biophysical topics with emphasis on recent and quantitative developments.

344. **GRADUATE SEMINAR.** I, II. 1-3 hr. per sem. PR: Graduate status and consent.

345. **BIOPHYSICAL ANALYSIS.** I. 4 hr. (alternate years). PR: Math. 117 (Calculus III) and Grad. Physiol. Application of mathematical and biophysical theory to the study of cellular, organ and organismal functions. 3 lect. 1 conf.-seminar.

347. **SYSTEM BIOPHYSICS.** II. 4 hr. (alternate years). PR: Physiol. 345. A quantitative analysis of physiological regulatory systems. 2 lect., 2 conf.-seminar.

397. **RESEARCH IN PHYSIOLOGY.** I, II, S. 1-15 hr.

PHYSICAL EDUCATION

ADMISSION

Students who wish to enter the Graduate School file application for admission with the Director of Admissions of the University. The applicant must request the registrar of the college or university previously attended to send an official transcript directly to the Director of Admissions at least one month in advance of registration days. Application forms may be obtained from the Director of Admissions of the University.

Admission to Graduate School does not constitute admission to candidacy for the Master of Science degree. The Chairman of Graduate Studies in the School of Physical Education will advise the student concerning departmental prerequisites and advanced degree requirements.†

THE DEGREE OF MASTER OF SCIENCE

The School of Physical Education offers courses leading to the Master of Science degree, with an emphasis in Health and Safety Education, Physical Education, or Recreation—or combination of all three areas.

Students are admitted for graduate work leading to the M.S. Degree in the School of Physical Education, provided they hold a baccalaureate degree from an approved college; have a 2.5 grade-point index for the work completed in their junior and senior undergraduate years; and satisfy prerequisites in the courses for which they register.

Students who do not meet the 2.5 grade-point average requirement may be admitted on probation and will be required to earn a 3.0 average in the first 12 semester hours of residence work in order to continue.

Students are accepted as advanced degree candidates on the basis of a preliminary qualifying examination following one semester, or two summer terms, (12 semester hours)* of graduate residence work provide they:

- A. Are certified to teach physical education; or have at least 24 semester hours, or its equivalent** which is an undergraduate minor in either physical education, health and safety education, recreation, or a combination in these areas. The equivalent is determined by the Committee on Graduate Courses.
- B. Demonstrate to the satisfaction of the Committee on Graduate Study by a Preliminary Comprehensive Examination, taken after completing 12 hours in residence, a grasp of the important phases and problems in the single interest area.

Thirty-six semester hours are required for the Master of Science degree, distributed as follows:

- I. A minimum of 24 semester hours in the areas of Health Education, Physical Education, Recreation, and/or Safety Education, of which:
 - A. 15 semester hours must be in a single interest area;† including the basic course, (Health Educ. 205 or Phys. Educ. 294, or Rec. 202, or Safety Educ. 283 and "Introduction to Research," HPERS 375).
 - B. 3 semester hours in each of two allied areas: Health Educ. 205, Phys. Educ. 294, Rec. 202, OR Safety Educ. 283.
- II. A minimum of 6 semester hours of approved course work in related areas other than Health Education, Physical Education, Recreation, and Safety Education.

*Courses taken in University Extension are accepted for degree purposes provided the student has had prior approval from his adviser.

**Experience in teaching Health, Physical Education, and Recreation Leadership, and coaching experience may be evaluated by special examination to adjust some of the undergraduate requirements.

†All entering graduate students must take the Graduate Record Examination General Aptitude test and students with an emphasis in Physical Education must take the Advanced Physical Education test.

†Health Education and Safety Education are considered a single area.

- III. Nine semester hours of electives in the specialized or related areas.
- IV. Six semester hours may be earned for the writing of a thesis; or 3 semester hours may be earned for the writing of a problem.
- V. A minimum of 12 semester hours must be in courses numbered 300 and above, 9 of which must be in the single interest area.
- VI. Degree candidates must have a 3.00 grade-point average for graduation.
- VII. Degree candidates must successfully pass the comprehensive examination which will include philosophy in the single interest area and two allied areas; measurement and evaluation; and research methodology.
- VIII. Degree requirements must be completed within 7 years from time of original matriculation.

CERTIFICATE OF ADVANCED STUDY PROGRAM

The program, in cooperation with the College of Human Resources and Education, is designed to prepare school and related personnel who wish professional training beyond the Master's degree. Candidates for this Certificate may choose from among the following areas of study for their specialization: Physical Education, Health, and Safety Education.

PREREQUISITES TO ADMISSION TO THE PROGRAM

- 1. General requirements for admission to the Graduate School of West Virginia University.
- 2. A Master's degree with a grade-point average of 3.0 or higher.
- 3. A minimum of three years of teaching or closely related educational experience.

REQUIREMENTS FOR ADMISSION TO CANDIDACY

- 1. Evidence through examination, personal letter, and personal interview of general proficiency, acceptable standards of oral and written communication, and good health.
- 2. Satisfactory completion *in residence* at West Virginia University of at least six semester hours of approved course work beyond the conferring of the Master's degree.

REQUIREMENTS FOR COMPLETION

The Program: An approved program consisting of a minimum of 30 semester hours earned above the Master's degree of which 24 semester hours will be course work in Education and closely related fields and 6 hours of research.

At least 24 semester hours of the work credited for this Certificate must be done in residence at West Virginia University. This requirement includes the 6 hours of research which may be conducted apart from the physical limits of the University but must be done under the direction and supervision of the chairman of the student's graduate committee. A maximum of 6 semester hours earned in residence at another approved graduate institution or in West Virginia University Extension may, if approved by the student's adviser, be allowed toward credit for the Certificate.

Final Examination(s): Upon completion of all requirements including the research report, the candidate will be admitted to a final oral examination by his graduate committee.

Time Limitation: All requirements must be completed within seven calendar years immediately preceding the awarding of the Certificate.

THE DEGREE OF DOCTOR OF EDUCATION

The degree of Doctor of Education is offered in cooperation with the College of Human Resources and Education. Admission to the Graduate School and enrollment in graduate courses do not themselves imply acceptance of the applicant for a Doctor of Education degree.

ADMISSION

Individuals who wish to pursue a program leading to the Doctor of Education degree must be admitted to the Graduate School of West Virginia University. All applicants for admission to the doctoral program must submit scores on the Aptitude Test of the Graduate Record Examination and otherwise comply with each of the General Regulations of the Graduate School outlined in Part I and Part II of the Graduate School Bulletin. Acceptance for study toward the doctoral degree in a specific area of concentration will be based on prior academic achievement including a cumulative grade-point average of 3.0 or above and a satisfactory score on the general aptitude test of the Graduate Record Examination or other appropriate measure of academic aptitude and an interview by the Doctoral Admissions Committee during the Preliminary Examination. Students having a cumulative grade-point average of less than 3.0 but having a satisfactory score on the Graduate Record Examination or other appropriate measure of academic aptitude may be admitted provisionally; final acceptance will be contingent upon the results of the Preliminary Examination. Students who meet the standards for admission set forth by the various programs will be assigned a temporary adviser.

PRELIMINARY EXAMINATION

The student must make application through his temporary adviser to the Chairman of Graduate Studies to take the Preliminary Examination. Usually, the examination is taken after tentative admission to the program and completion of six to twelve hours of doctoral work at West Virginia University. A maximum of eighteen (18) hours credit or doctoral work completed at West Virginia University prior to the preliminary examination may be counted.

The purposes of the preliminary examination are to discuss with the student his proposed areas of doctoral study, and to make appropriate recommendations concerning his acceptance into an area of concentration and acceptability of prior work to meet program requirements.

The composition of the preliminary examining committee shall include, at least, the Chairman of Graduate Studies, the coordinator of major program, the coordinator(s) of minor program(s), and the student's temporary adviser. Prior academic achievement, professional experiences, test results, and other evidences of competence in areas essential for successful completion of the Doctor of Education Degree will be taken into consideration.

DOCTORAL COMMITTEE

Having received an affirmative recommendation from the preliminary examination committee to continue doctoral work, a permanent adviser to serve as the student's chairman of the doctoral committee will be selected by the Dean, Director of the Division, and the Coordinator of the Major Program. At least four additional committee members will be selected by the permanent adviser and student.

CURRICULUM

The final determination of the program of course work and research is the responsibility of the student's doctoral committee. The Doctor of Education degree is not awarded on the basis of the completion of any set number of credits but is awarded on the basis of demonstrated academic achievement and scholarly competence. The minimum course work shall be 70 semester hours of graduate work, excluding dissertation credit but including credits of relevant graduate work completed at the master's degree level. A minimum of 24 of the 70 semester hours shall be in the area of major concentration and a minimum of 24 of the 70 semester hours from a minor area of concentration in a supporting or related discipline.

Candidates having previously earned a graduate degree from West Virginia University will be required to earn credit while in residence at another graduate institution offering the doctorate in the student's major field. The student's doctoral committee shall approve the institution and the course work. In every case, a minimum of two semesters in residence at West Virginia University as a full-time doctoral student will be required. Requirements for the Doctor of Education degree must be completed within seven years after successful completion of the preliminary examination.

ADMISSION TO CANDIDACY EXAMINATION

The purposes of the admission to candidacy examination are to assess the quality of the student's academic achievement, to review the student's program of course work, to approve a proposed outline of dissertation research, and to admit the student to formal candidacy for the degree.

The examination may be taken after at least two-thirds of the student's program of course work has been completed but prior to the dissertation phase of the program. The admission to candidacy examination consists of two parts: (a) a written examination, and (b) an oral examination. The candidate must pass the written examination prior to taking the oral portion. The written examination will include a common "foundations" section (history and philosophy of education, research design and statistics, social and psychological foundations) and specifically prepared written examinations in the major area of concentration and in the area of concentration in the supporting discipline. The written examination may be repeated one time and, upon consent of the Dean, Director of Division, and Coordinator of Major Program may be repeated a second and third time. At least six months must elapse between repeated examinations.

The oral portion of the admission to candidacy examination will be administered by the student's doctoral committee at the call of and under the direction of the committee chairman after successful completion of written portion of examination. The oral portion of the examination may be repeated one time and on recommendation of the doctoral committee, may be repeated a second time. At least six months must elapse between repeated examinations. On successful completion of the admission to candidacy examination, the student will be admitted to formal candidacy for the doctoral degree.

DISSERTATION

The candidate must submit and justify an outline or a prospectus for his doctoral dissertation at the oral portion of the admission to candidacy examination. The doctoral committee must review and *approve, approve with change, or reject* this outline or prospectus. The student shall systematically consult with members of the doctoral committee and with other appropriate members of the University faculty during the dissertation phases of his program.

FINAL ORAL EXAMINATION

The student will be admitted to a final oral examination upon completion of his dissertation and after he has fulfilled all other requirements set by his committee. This examination will be conducted by his doctoral committee and will be open to all members of the University faculty. The candidate will not be recommended for the doctoral degree if he receives more than one unfavorable vote from his doctoral committee.

DANCE

215. **RHYTHMS AND DANCE. II, S. 3 hr. PR:** Graduate standing and consent. Principles of movement, materials, and practicum in dance.
219. **MODERN DANCE TECHNIQUES AND COMPOSITION. I, S. 3 hr. PR:** Phys. Educ. 35 and 36, graduate standing and consent. Application of scientific principles of movement; basic principles of music as related to dance movement; choreographic principles; practicum in dance movement. Principles for teaching the dance and problems involved in planning programs.
296. **AMERICAN FOLK DANCE. I, S. 3 hr. PR:** Phys. Educ. 132 or equiv. Study of American Square, contra, circle, and round dances and play party games, and their place in community and school recreation programs. Their origin and relationship to the arts and other aspects of American culture. Analysis of techniques in leading and calling.
319. **HISTORY AND PHILOSOPHY OF THE DANCE. II, S. 3 hr. PR:** Phys. Educ. 219 or equiv. A cultural survey of the dance as an expression of the society it represents; philosophy of the dance; the relation of dance to other art forms; dance as an educational experience and the study of the works of the outstanding artists of today.

HEALTH EDUCATION

201. ADVANCED SCHOOL HEALTH. I, S. 3 hr. PR: Health Educ. 101, 20 hr. of Education, graduate standing and consent. An analysis of problems in school health services, healthful school living, the nature of health education, and the scope of health instruction which confronts teachers and administrators.
205. PHILOSOPHY OF HEALTH EDUCATION. I, S. 3 hr. PR: Health Educ. 2, and 101, graduate standing and consent. Analysis of the scientific bases, purposes, procedures, and content, with implications for school and public health education programs.
301. COMMUNITY HEALTH. II, S. 3 hr. PR: Health Educ. 2, and 205, or equiv. Health problems requiring community action, basic public health activities, community organization for health protection, voluntary health agencies, school health programs and the role of state and federal agencies in the community health program.
376. EVALUATION OF HEALTH INFORMATION. I, S. 3 hr. PR: Health Educ. 2, and 201, or 20 hr. of Education and consent. Study of published material to determine basic scientific accuracy and value.
394. SEMINAR IN HEALTH EDUCATION. I, II, S. 4 hr. PR: Health Educ. 205. An overview and critical analysis of the literature and research in health education.
397. INDIVIDUAL RESEARCH PROBLEMS IN HEALTH EDUCATION. I, II, S. 1-15 hr. PR: Minimum of 6 sem. hr. in Health Educ., including Health Educ. 205, and HPERS* 375 or 395, or Educ. 301. Opportunity for independent study and investigation of pertinent problems. For advanced students with practical experience.
398. PRACTICUM IN HEALTH EDUCATION. I, II, S. 4 hr. PR: Health Educ. 394, and HPERS 396 and 397. Program planning, curriculum development and job functions in health education.

PHYSICAL EDUCATION

206. PROGRAM IN INDIVIDUAL SPORTS. S. 3 hr. PR: Graduate standing and consent. Designed for coaches of interscholastic athletics. A study of advanced coaching techniques and methods in track and field activities, wrestling, and gymnastics.
207. PROGRAM IN TEAM SPORTS. S. 3 hr. PR: Graduate standing and consent. Designed for coaches of interscholastic athletics. A study of advanced techniques, systems of play, offense, defense, methodology, staff organization, and related problems in the coaching of football, basketball and baseball.
208. ADVANCED ATHLETIC TRAINING AND CONDITIONING. I, S. 3 hr. PR: Phys. Educ. 121, 175; Zool. 171, or equiv. To acquaint graduate students with recent theories, practices, and techniques in the prevention, care, and treatment of athletic injuries.
210. PROGRAM IN SPORTS. S. 3 hr. (W). PR: Phys. Educ. 31, 32, graduate standing and consent. Designed for women engaged in teaching and coaching. Organization and administration of individual, dual, and team sports. Practicum in girls' and women's sports.
211. ORGANIZATION AND ADMINISTRATION OF INTRAMURAL SPORTS. I, S. 3 hr. PR: 4 hr. of physical education activity courses, graduate standing and consent. Critical analysis with view to justification from standpoint of objectives and of contribution to general welfare of students participation. Organization and administration of programs on secondary and college levels.
212. EXTRACURRICULAR PHYSICAL EDUCATION ACTIVITIES FOR SECONDARY SCHOOL GIRLS. I, S. 3 hr. PR: Graduate standing and consent. Critical analysis of physical education extracurricular activities from the standpoint of objective and contribution to the general welfare of the participants; value of the activities in

the school and community; relationship to the physical education program; problems associated with the organization and administration of the program.

213. ADMINISTRATION OF ATHLETICS. S. 3 hr. PR: Experience in coaching and administration. Graduate standing and consent. The course is designed for persons engaged in actual coaching and administration. A study of the problems associated with the organization and administration of interscholastic and intercollegiate athletic programs and their relationship to physical education.

275. PRINCIPLES AND PRACTICES OF ADAPTED PHYSICAL EDUCATION. I, S. 3 hr. PR: Zool. 171, Phys. Educ. 175, or equiv. Principles and philosophy in building an adapted program, types of injuries, classification of students, and application of adapted exercises.

276. PHYSICAL EDUCATION FOR THE MENTALLY RETARDED. I, S. 3 hr. PR: Consent. Philosophy, objectives, activities, equipment, program planning, and evaluation of physical education programs for the mentally retarded.

278. ADMINISTRATION OF PHYSICAL EDUCATION. II, S. 3 hr. PR: Phys. Educ. 71, 177. Modern theories in physical education and guiding principles in organization and administration of the program.

292. PHYSICAL EDUCATION IN THE ELEMENTARY SCHOOL. I, S. 3 hr. PR: Teaching experience or consent. Philosophy, objectives, activities, equipment, utilization of space, program planning, and evaluation for a functional program in elementary school physical education.

294. PHILOSOPHY OF PHYSICAL EDUCATION. I, II, S. 3 hr. PR: Phys. Educ. 117 and 278, graduate standing and consent. Study of the place of physical education in education and modern living; philosophic processes in physical education; critical analysis of various problems confronting the physical educator.

295. RESIDENCE IN CORRECTIVE THERAPY. S. 6 hr. PR: Phys. Educ. 175, 176, and selected psychology courses. An intensive 6-week course offered during the Summer under the auspices of the professional staff of a hospital. The course consists of 240 clock hours of staff lectures and practical clinical experience in corrective therapy as it is integrated in the Physical Medicine and Rehabilitation Program of a hospital.

380. CURRICULUM DEVELOPMENT IN PHYSICAL EDUCATION. S. 3 hr. PR: Phys. Educ. 294. Application of principles of growth and development of various age groups to program planning in physical education; evaluation of activities; formulation of criteria as a basis for curriculum revision to meet changing needs in the schools program. (Limited to major students.)

394. SEMINAR IN PHYSICAL EDUCATION. I, II, S. 4 hr. PR: Phys. Educ. 294. An overview and critical analysis of the literature and research in physical education.

397. INDIVIDUAL RESEARCH PROBLEMS IN PHYSICAL EDUCATION. I, II, S. 1-15 hr. PR: Minimum of 6 sem. hr. in Phys. Educ., including Phys. Educ. 294, and HPERS 375 or 395; or Educ. 301. Opportunity for independent study and investigation of pertinent problems. For advanced students with practical experience.

398. PRACTICUM IN PHYSICAL EDUCATION. I, II, S. 4 hr. PR: Phys. Educ. 394, and HPERS 396 and 397. Program planning, curriculum development, and job functions in physical education.

RECREATION

202. PHILOSOPHY OF RECREATION. II, S. 3 hr. PR: Major students in Recreation, Forestry, graduate students in Education and Physical Education; or consent. Interpretation of recreation as a basic part of the living process; importance to individual, community, and national welfare; social and economic significance.

204. **RECREATION HOBBIES.** I, S. 2 hr. PR: Rec. 1 or equiv. Lecture and workshop. Value of hobbies to youth and adults; participation in various types or hobbies; methods of organization and presentation; nature and scope.

206. **SOCIAL RECREATION FOR SCHOOL-AGE GROUPS.** II, S. 3 hr. PR: 12 hr. in Education or consent. Workshop course. Planning and conduct of social activities, parties, picnics, special events and other recreation experience adapted to home, church, school, and community.

265. **LEISURE AND RECREATION.** I, S. 3 hr. PR: Physical Education, Forestry, Recreation majors or 14 hr. in Education or consent. Study of leisure as a social phenomenon in our modern culture and its implications for recreation.

271. **ADMINISTRATION OF CAMPS AND PREPARATION OF CAMP COUNSELORS.** II, S. 3 hr. PR: Rec. 11 or equiv. or consent. Principles involved in modern camping programs; organization and administration of camps.

282. **ADMINISTRATION OF RECREATION.** I, S. 3 hr. PR: Major in Recreation, Forestry, graduate status in Education or Physical Education, or consent. General principles of administration; organization of staff administrative procedures. Study of enabling laws, legal responsibilities, survey, finance, programs, facilities, and public relations.

290. **OUTDOOR EDUCATION AND SCHOOL CAMPING.** 3 hr. PR: For majors in Education, Recreation, Extension, and Forestry, or consent. Course designed to meet the needs of schools, colleges, and other education and conservation agencies interested in developing outdoor education programs. Emphasis is upon interpretation and programming of the outdoor education concept.

293. **OUTDOOR RECREATION IN OUR MODERN SOCIETY.** 3 hr. PR: For persons in fields of recreation, park, outdoor education and conservation, or consent. Interpretation as to what it is, what people do, where they go, how this affects our economic, social, and cultural life and significant trends.

305. **HUMAN INTEREST AREAS IN RECREATION PLANNING.** I, II, S. 3 hr. PR: Rec. 202 or 20 hr. in Education or equiv. Exploration of the human interest areas which are the sources of recreation program content. Their adaptation to school and municipal recreation program planning.

306. **LEADERSHIP IN SCHOOL-AGE RECREATION PROGRAMS.** II, S. 2 hr. PR: Rec. 107 or two years' teaching experience. Leadership techniques used in various recreation activities of school-age groups. Analysis of differences between teaching and recreation leadership.

307. **COMMUNITY RECREATION.** I, S. 3 hr. PR: Rec. 202 or consent. A study of problems related to the provision of adequate recreation services for a community. Standards and quality of recreation service; methods of measuring existing services and their coordination; and community organization procedures. Course is designed for leaders in voluntary agencies, schools, churches, and municipal recreation organizations.

394. **SEMINAR IN RECREATION.** I, II, S. 4 hr. PR: Rec. 202. An overview and critical analysis of the literature and research in recreation.

397. **INDIVIDUAL RESEARCH PROBLEMS IN RECREATION.** I, II, S. 1-15 hr. PR: Minimum of 6 sem. hr. in Recreation, including, Rec. 202 or 265, HPERS 375 or 395, or Educ. 301. Opportunity for independent study and investigation of pertinent problems. For advanced students with practical experience.

398. **PRACTICUM IN RECREATION.** I, II, S. 4 hr. PR: Rec. 394, HPERS 396 and 397. Program planning, curriculum development, and job functions in recreation.

SAFETY EDUCATION

280. **PROGRAMS IN SAFETY EDUCATION.** I, II, S. 3 hr. PR: Graduate standing and consent. Planning programs, methods and materials for offering instructional

programs in safe living in school, home, travel, industry, physical education, athletics, and recreation.

281. **DRIVER AND TRAFFIC SAFETY EDUCATION PROGRAMS.** II, S. 3 hr. PR: Safety Educ. 280 or equiv., or 20 hr. of Education, graduate standing and consent. Philosophy, objectives, new and advanced equipment, methods and materials in driver and traffic safety education; program planning and evaluative techniques in schools and adult programs. Includes laboratory with various methods, materials, and instructional techniques.
282. **PROBLEMS IN DRIVER AND TRAFFIC SAFETY EDUCATION.** I, II, S. 3 hr. PR: Safety Educ. 281 or equiv. or teaching experience in driver education, and graduate standing and consent. An advanced course which gives consideration to individual problems encountered in teaching driver and traffic safety education. Examination of existing courses of study, research and supervisory and evaluative practices.
283. **PHILOSOPHY OF SAFETY EDUCATION.** I, II, S. 3 hr. PR: Safety Educ. 280, 281, or 20 hr. of Education, graduate standing and consent. Study of the place of safety education in modern living; philosophies of safety education as expounded by leaders in the field; emphasis on accident causation and accident prevention in various areas of safety; and research implications.
365. **ORGANIZATION, ADMINISTRATION, AND SUPERVISION OF SCHOOL SAFETY EDUCATION.** I, II, S. 3 hr. PR: 20 hr. of Education or Safety Educ. 280 or 283 or equiv., and consent. Designed for teachers, school administrators, college instructors, and others responsible for directing or supervising safety programs in the school. Deals with the problems, policies, practices, and procedures involved in the organization, administration, and supervision of a comprehensive accident prevention and safety education program for the school. Considers integration factors of the school safety programs with the community safety program.
394. **SEMINAR IN SAFETY EDUCATION.** I, II, S. 4 hr. PR: Safety Educ. 283. An overview and critical analysis of the literature and research in safety education.
397. **INDIVIDUAL RESEARCH PROBLEMS IN SAFETY EDUCATION.** I, II, S. 1-15 hr. PR: Minimum of 6 sem. hr. in Safety Educ., including Safety Educ. 283, HPERS 375 or 395, or Educ. 301. Opportunity for independent study and investigation of pertinent problems. For advanced students with practical experience.
398. **PRACTICUM IN SAFETY EDUCATION.** I, II, S. 4 hr. PR: Safety Educ. 394, and HPERS 396 and 397. Program planning, curriculum development, and job functions in safety education.

HPERS

HPERS courses involve all areas — Health Education, Physical Education, Recreation, and Safety Education.

200. **WORKSHOP.** 1-16 hr.
 - I. **HEALTH EDUCATION**
 - II. **PHYSICAL EDUCATION**
 - III. **RECREATION**
 - IV. **SAFETY EDUCATION**
301. **THE ROLE OF THE SCHOOL ADMINISTRATOR IN CONDUCTING PROGRAMS IN HEALTH, PHYSICAL EDUCATION, RECREATION, AND SAFETY.** S. 2 hr. PR: 20 hr. in Education. A seminar for school administrators on the solution of problems associated with planning, scheduling and conducting school programs in health, physical education, recreation, and safety. Consideration is given to program, activity, leadership, facilities, supplies, equipment, finances and supervision. (Not open to major students.)
350. **MEASUREMENT IN HEALTH EDUCATION, PHYSICAL EDUCATION, SAFETY EDUCATION, AND RECREATION.** II, S. 3 hr. PR: Health Educ. 205 or Phys. Edus. 294 or Safety Educ. 283 or Rec. 202. An analysis of evaluative data through statistical procedures and the construction and interpretation of tests.

352. STATISTICAL ANALYSIS IN HEALTH, SAFETY, PHYSICAL EDUCATION, AND RECREATION. II, S. 3 hr. PR: HPERS 350. The relationship between advanced statistical analyses and experimental designs in research.

355. PROBLEMS IN HEALTH, PHYSICAL EDUCATION, RECREATION, AND SAFETY. I, S. 3 hr. PR: Health Educ. 205 or Phys. Educ. 294 or Rec. 202 or Safety Educ. 283. Content and relationship among physical education, health education, recreation, and safety program. Aims to develop critical analysis. Follows seminar procedure and presupposes broad academic experience on part of the student.

375. INTRODUCTION TO RESEARCH. II, S. 3 hr. PR: Health Educ. 205 or Phys. Educ. 294 or Rec. 202 or Safety Educ. 283. An analysis of the nature and purpose of research with an emphasis upon types and techniques applicable to the areas of health, physical education, recreation, and safety. (Required of all Master of Science degree candidates.)

394. SUPERVISION. I, II, S. 3 hr. PR: HPERS 396 and Educ. 336 or Educ. 335 or Educ. 341. A study and evaluation of supervisory policies, practices, and techniques in health education, physical education, recreation, safety education.

395. RESEARCH SEMINAR. II. S. 3 hr. PR: Health Educ. 394 or Phys. Educ. 394 or Rec. 394 or Safety Educ. 394 and HPERS 375 or Educ. 301. Analysis of research design, compilation, organization, treatment and interpretation of data for research projects in health, physical education, recreation and safety. (Required of all candidates for the Doctoral Degree.)

396. ADMINISTRATION POLICIES. I, II, S. 3 hr. PR: Health Educ. 394 or Phys. Educ. 394 or Rec. 394 or Safety Educ. 394, and Educ. 339 or Educ. 340. A study and evaluation of administrative policies and practices in health education, physical education, recreation, safety education, and athletics.

399. THESIS. I, II, S. 6 hr. PR: HPERS 375 or 395.

Part V

THE GRADUATE FACULTY

Ex officio members: The President of the University, the Vice-Presidents, the Provost, and Deans of the various colleges and schools.

COLLEGE OF AGRICULTURE AND FORESTRY

AGRICULTURAL BIOCHEMISTRY

HOMER PATRICK, PH.D. (Penn. St. U.), *Chairman and Professor of Agricultural Biochemistry* (1963), 1957.

WILLIAM G. MARTIN, PH.D. (WVU), *Assistant Professor of Agricultural Biochemistry* (1963), 1958.

A. H. VANLANDINGHAM, PH.D. (WVU), *Director of Agricultural Experiment Station; Associate Dean of College of Agriculture and Forestry; Professor of Agricultural Biochemistry* (1959), 1929.

AGRICULTURAL ECONOMICS

ROBERT L. JACK, PH.D. (Penn. St. U.), *Acting Chairman and Assistant Professor of Consumer Economics and Assistant Agricultural Economist* (1965), 1963.

ALFRED L. BARR, PH.D. (Okla. St. U.), *Associate Professor of Agricultural Economics* (1961).

JAMES H. CLARKE, M.S. (U. Ky.), *Professor of Agricultural Economics* (1960), 1939.

HOMER C. EVANS, PH.D. (U. Minn.), *Professor of Agricultural Economics* (1959).

KENNETH D. MCINTOSH, PH.D. (U. Wisc.), *Assistant Professor of Agricultural Economics* (1957).

RALPH E. NELSON, PH.D. (U. Minn.), *Associate Professor of Agricultural Economics* (1964).

ERNEST J. NESIUS, PH.D. (Iowa St. U.), *Professor of Agricultural Economics* (1960).

PAUL E. NESSEROAD, M.S. (WVU), *Assistant Professor of Agricultural Economics* (1954).

JAMES L. STALLINGS, PH.D. (Mich. St. U.), *Assistant Professor of Agricultural Economics* (1965).

GEORGE E. TOBIN, M.S. (U. Ill.), *Professor of Agricultural Economics* (1960), 1946.

AGRICULTURAL EDUCATION

RUSSELL C. BUTLER, PH.D. (Cornell U.), *Chairman and Professor of Agricultural Education and Professor of Education* (1965), 1944.

PAUL V. ARMBRESTER, M.S. (WVU), *Assistant Professor of Agricultural Education, and Chief of Party and Vocational Agricultural Adviser at Dar es Salaam, Tanzania* (1966), 1963.

WARREN G. KELLY, M.S. (WVU), *Assistant Professor of Agricultural Education and Assistant Professor of Education* (1957).

ROBERT H. MAXWELL, M.S. (Iowa St. U.), *Assistant Professor of Agricultural Education, and Chief of Party, Vo-Ag Project, Nairobi, Kenya* (1966), 1964.

O. CLAUDE MCGHEE, M.S. (WVU), *Assistant Professor of Agricultural Education and Assistant Professor of Education* (1961).

DIXON W. PARSONS, PH.D. (Cornell U.), *Professor Emeritus of Agricultural Education and Professor Emeritus of Education* (1951), 1923.

AGRICULTURAL ENGINEERING

See page 239.

AGRONOMY AND GENETICS

G. GORDON POHLMAN, PH.D. (Iowa St. U.), *Chairman and Professor of Agronomy* (1938), 1930.

O. J. BURGER, PH.D. (Purdue U.), *Professor of Agronomy* (1959), 1950.

DONALD P. DOOLITTLE, PH.D. (Cornell U.), *Assistant Professor of Genetics* (1966).
 CARL F. ENGLE, PH.D. (Penn. St. U.), *Assistant Professor of Agronomy* (1964).
 PAUL R. HENDERLONG, PH.D. (VPI), *Assistant Professor of Agronomy* (1964).
 EVERETT M. JENCKS, PH.D. (Rutgers U.), *Assistant Professor of Agronomy* (1957).
 GERALD A. JUNG, PH.D. (U. Wisc.), *Associate Professor of Agronomy* (1962), 1957.
 ROBERT F. KEEFER, PH.D. (Ohio St. U.), *Assistant Professor of Agronomy* (1965).
 JOGINDER NATH, PH.D. (U. Wisc.), *Assistant Professor of Genetics* (1966).
 IGOR V. SARKISSIAN, PH.D. (Purdue U.), *Associate Professor of Genetics* (1962).
 VALENTIN ULRICH, PH.D. (Rutgers U.), *Associate Professor of Genetics* (1962), 1957.
 COLLINS VEATCH, PH.D. (U. Ill.), *Professor of Agronomy* (1959), 1945.

ANIMAL INDUSTRY AND VETERINARY SCIENCE

MARVIN R. MCCLEUNG, PH.D. (Iowa St. U.), *Chairman and Professor of Animal Industry and Veterinary Science* (1964), 1942.
 RICHARD A. ACKERMAN, M.S. (WVU), *Assistant Professor of Dairy Science* (1946), 1928.
 GERALD C. ANDERSON, PH.D. (U. Mo.), *Professor of Animal Science* (1955), 1950.
 DONALD F. BUTCHER, PH.D. (Iowa St. U.), *Assistant Professor of Dairy Science* (1965).
 ARTHUR A. CAMP, PH.D. (Tex. A & M), *Assistant Professor of Poultry Science* (1965).
 LESLIE DOZSA, D.V.M. (U. Budapest), *Associate Professor of Veterinary Science* (1961), 1957.
 ROBERT S. DUNBAR, JR., PH.D. (Cornell U.), *Dean of the College of Agriculture and Forestry and Professor of Animal Science* (1964), 1952.
 DONALD J. HORVATH, PH.D. (Cornell U.), *Associate Professor of Animal Science* (1960), 1957.
 HAROLD M. HYRE, M.S. (Cornell U.), *Associate Professor of Poultry Science* (1944), 1931.
 EMMETT K. INSKEEP, PH.D. (U. Wisc.), *Assistant Professor of Animal Science* (1964).
 ROBERT O. KELLEY, PH.D. (U. Missouri), *Assistant Professor of Animal Science* (1967), 1966.
 HAROLD E. KIDDER, PH.D. (U. Wisc.), *Professor of Animal Science* (1960), 1954.
 JAMES L. MCBEE, PH.D. (U. Mo.), *Associate Professor of Animal Science* (1964), 1959.
 GEORGE A. MCLAREN, PH.D. (Okla. St. U.), *Professor of Nutritional Biochemistry* (1963), 1955.
 NORMAN O. OLSON, D.V.M. (Wash. St. U.), *Professor of Veterinary Science* (1948).
 RONALD A. PETERSON, PH.D. (Mich. St. U.), *Assistant Professor of Poultry Science* (1966).
 ROBERT L. REID, PH.D. (Aberdeen U.), *Associate Professor of Animal Nutrition* (1963), 1957.
 ROY O. THOMAS, PH.D. (Mich. St. U.), *Assistant Professor of Animal Nutrition* (1964).
 BENJAMIN W. WAMSLEY, JR., M.S. (WVU), *Instructor in Animal Science* (1967), 1948.
 SAMUEL J. WEESE, M.A. (WVU), *Associate Professor of Dairy Science* (1951), 1945.
 JAMES A. WELCH, PH.D. (U. Ill.), *Professor of Animal Science and Animal Husbandman* (1960), 1952.

FORESTRY

DAVID E. WHITE, PH.D. (St. U. N.Y.), *Director and Assistant Professor of Forest Economics* (1966), 1964.
 ARTHUR B. BRAUNER, M.W.T. (U. Mich.), *Assistant Professor of Wood Science* (1963).
 SAMUEL M. BROCK, PH.D. (U. Minn.), *Assistant Professor of Forest Economics* (1965).
 MAURICE G. BROOKS, M.S. (WVU), *Professor of Wildlife Management* (1947), 1938.
 JAMES H. BROWN, M.F. (Yale U.), *Assistant Professor of Silviculture* (1957).
 KENNETH L. CARVELL, D.FOR. (Duke U.), *Professor of Silviculture* (1964), 1953.
 FRANKLIN C. CECH, PH.D. (Tex. A & M), *Associate Professor of Forest Genetics* (1964).
 ALLEN W. GOODSPED, M.F. (Yale U.), *Professor of Forest Management* (1949).
 DAVID A. GROOM, M.W.T. (U. Mich.), *Instructor and Research Assistant in Wood Science* (1964).
 JOHN R. HAMILTON, PH.D. (N.C. St.), *Professor of Wood Science* (1964).
 NORMAN D. JACKSON, M.W.T. (N.C. St.), *Assistant Professor of Wood Science* (1961), 1953.
 CHRISTIAN B. KOCH, PH.D. (U. Mich.), *Associate Professor of Wood Science* (1964), 1951.
 DON L. KULOW, PH.D. (Mich. St. U.), *Assistant Professor of Forest Mensuration* (1963).
 W. CLEMENT PERCIVAL, PH.D. (St. U. N.Y.), *Professor of Forestry* (1966), 1934.

ROBERT L. SMITH, PH.D. (Cornell U.), *Associate Professor of Wildlife Management* (1958).

FARL H. TRYON, PH.D. (Yale U.), *Professor of Silviculture* (1952), 1945.

HORTICULTURE

EION G. SCOTT, PH.D. (U. Calif.), *Chairman and Professor of Horticulture* (1962).

WILLIAM H. CHILDS, PH.D. (Cornell U.), *Professor of Horticulture* (1953), 1931.

ARTHUR P. DYE, M.S. (WVU), *Associate Professor of Horticulture* (1962), 1923.

MORRIS INGLE, PH.D. (Purdue U.), *Associate Professor of Horticulture* (1966), 1963.

GEORGE W. LONGENECKER, M.F.A. (U. Ill.), *Assistant Professor of Landscape Architecture* (1966).

RAY S. MARSH, A.M. (U. Mo.), *Professor Emeritus of Horticulture* (1965), 1936.

OLIVER M. NEAL, JR., PH.D. (Mich. St. U.), *Professor of Horticulture* (1963), 1942.

OSCAR E. SCHUBERT, PH.D. (U. Ill.), *Professor of Horticulture* (1961), 1949.

GLENN E. STEYERS, M.S. (Penn St. U.), *Associate Professor of Horticulture* (1960).

ALLEY E. WATADA, PH.D. (U. Calif.), *Assistant Professor of Horticulture* (1965).

KYLE C. WESTOVER, PH.D. (Cornell U.), *Professor Emeritus of Horticulture* (1963), 1921.

PLANT PATHOLOGY, BACTERIOLOGY, AND ENTOMOLOGY

HORACE L. BARNETT, PH.D. (Mich. St. U.), *Chairman of Plant Pathology, Bacteriology, and Entomology and Professor of Mycology* (1960), 1945.

ROBERT E. ADAMS, PH.D. (Cornell U.), *Associate Professor of Plant Pathology* (1960), 1953.

LOWELL L. BLACK, PH.D. (U. Wisc.), *Assistant Professor of Plant Pathology* (1965).

CARL K. DORSEY, PH.D. (U. Md.), *Professor of Entomology* (1951).

EDWARD S. ELLIOTT, PH.D. (WVU), *Associate Professor of Plant Pathology* (1961), 1953.

MANNON E. GALLEGLY, JR., PH.D. (U. Wisc.), *Professor of Plant Pathology* (1960), 1949.

JOHN A. KOBURGER, PH.D. (N.C. St.), *Associate Professor of Agricultural Bacteriology* (1966), 1962.

VIRGIL G. LILLY, PH.D. (WVU), *Professor of Physiology* (1949), 1927.

RODNEY P. TRUE, PH.D. (U. Penn.), *Professor of Plant Pathology* (1955), 1949.

HAROLD A. WILSON, PH.D. (Iowa St. U.), *Professor of Agricultural Bacteriology* (1957), 1947.

COLLEGE OF ARTS AND SCIENCES

BIOLOGY

JAY BARTON II, PH.D. (U. Mo.), *Chairman and Professor of Biology* (1966).

CHARLES H. BAER, PH.D. (U. Md.), *Associate Professor of Biology* (1956), 1948.

ELIZABETH ANN BARTHOLOMEW, M.S. (WVU), *Curator of Herbarium and Instructor in Biology* (1963), 1938.

HERALD D. BENNETT, PH.D. (St. U. Iowa), *Professor of Botany* (1961), 1948.

ARNOLD BENSON, M.A. (U. Colo.), *Assistant Professor of Biology* (1965), 1959.

ROBERT LEE BIRCH, M.S. (Penn. St. U.), *Assistant Professor of Biology* (1965), 1948.

DAVID F. BLAYDES, PH.D. (U. Ind.), *Assistant Professor of Biology* (1965).

W. NEWMAN BRADSHAW, PH.D. (U. Tex.), *Associate Professor of Biology* (1967), 1962.

ALBERT G. CANARIS, PH.D. (Wash. St. U.), *Associate Professor of Zoology* (1962).

HWA-RUEY CHEN, PH.D. (Yale U.), *Assistant Professor of Botany* (1966).

ROY B. CLARKSON, PH.D. (WVU), *Associate Professor of Biology* (1965), 1956.

JESSE F. CLOVIS, PH.D. (Cornell U.), *Associate Professor of Biology* (1963), 1957.

WILLIAM COLLINS, PH.D. (U. Wisc.), *Assistant Professor of Biology* (1967).

MULLEN O. COOVER, M.S. (WVU), *Assistant Professor of Biology* (1967), 1950.

EARL L. CORE, PH.D. (Columbia U.), *Professor of Botany* (1948), 1928.

LLOYD R. GRIBBLE, PH.D. (WVU), *Associate Dean, Arts and Sciences, and Professor of Zoology* (1947), 1929.

WILLIS H. HERTIG, JR., PH.D. (WVU), *Assistant Professor of Biology* (1964), 1960.

HENRY W. HURLBUTT, PH.D. (U. Md.), *Assistant Professor of Zoology* (1963).

ETHEL C. MONTIEGEL, M.S. (WVU), *Assistant Professor of Zoology* (1965), 1956.

CHARLES NORMAN, PH.D. (U. Iowa), *Professor of Biology* (1961), 1953.

CHEMISTRY

VINCENT J. TRAYNELIS, PH.D. (Wayne St. U.), *Chairman and Professor of Chemistry* (1965).
ROGER V. CHIASTAIN, JR., PH.D. (U. Wash.), *Assistant Professor of Chemistry* (1966).
ARMAND R. COLLETT, PH.D., *Professor Emeritus of Chemistry* (1965), 1924.
JOHN A. GIBSON, JR., PH.D. (M.I.T.), *Professor of Chemistry* (1952), 1926.
JACK D. GRAYBEAL, PH.D. (U. Wisc.), *Associate Professor of Chemistry* (1962), 1957.
GEORGE A. HALL, JR., PH.D. (Ohio St. U.), *Associate Professor of Chemistry* (1956), 1950.
JAMES L. HALL, PH.D. (U. Wisc.), *Professor of Chemistry* (1955), 1946.
JAMES B. HICKMAN, PH.D. (Penn St. U.), *Professor of Chemistry* (1962), 1946.
GEORGE L. HUMPHREY, PH.D. (Ore. St. U.), *Associate Chairman and Professor of Chemistry* (1964), 1952.
CHARLES L. LAZZELL, PH.D. (Yale U.), *Professor Emeritus of Chemistry* (1967), 1921.
CHARLES G. McCARTY, PH.D. (U. Ill.), *Assistant Professor of Chemistry* (1964).
BAILIE J. MCCORMICK, PH.D. (Okla. St. U.), *Assistant Professor of Chemistry* (1964).
DENIS W. H. MACDOWELL, PH.D. (M.I.T.), *Associate Professor of Chemistry* (1965), 1959.
CHESTER W. MUTH, PH.D. (Ohio St. U.), *Professor of Chemistry* (1963), 1949.
ARMIN D. PAUL, PH.D. (U. Calif.), *Associate Professor of Chemistry* (1961), 1955.
PETER POPOVICH, PH.D. (Wash. St. U.), *Associate Professor of Chemistry* (1960), 1946.
JOHN H. STROHL, PH.D. (U. Wisc.), *Assistant Professor of Chemistry* (1964).
ANTHONY WINSTON, PH.D. (Duke U.), *Associate Professor of Chemistry* (1965), 1959.

ENGLISH

JAMES P. BRAWNER, PH.D. (U. Ill.), *Chairman and Professor of English* (1952), 1935.
ROBERT W. CLARKE, PH.D. (U.C.L.A.), *Assistant Professor of English* (1966).
LLOYD M. DAVIS, M.A. (Vanderbilt U.), *Instructor in English* (1959).
RUEL E. FOSTER, PH.D. (Vanderbilt U.), *Professor of English* (1957), 1941.
WILLIAM W. FRENCH, M.A. (U. of Pitt), *Instructor in English* (1964).
PATRICK W. GAINER, PH.D. (St. Louis U.), *Professor of English* (1957), 1946.
JOHN L. HICKS, JR., M.A. (Ind. U.), *Associate Professor of English* (1964), 1949.
JOHN H. JOHNSTON, PH.D. (U. Wisc.), *Associate Professor of English* (1964), 1954.
RUSSELL C. MACDONALD, PH.D. (U. Penn.), *Assistant Professor of English* (1965).
MARY NADINE PAGE, M.A. (U. Chicago), *Assistant Professor of English* (1946), 1925.
VIRGIL A. PETERSON, PH.D. (U.C.L.A.), *Associate Professor of English* (1966).
JOHN RACIN, JR., PH.D. (Ohio St. U.), *Associate Professor of English* (1966), 1964.
JOHN F. STASNY, M.A. (Marquette U.), *Instructor in English* (1966), 1955.

FOREIGN LANGUAGES

ROBERT STILWELL, PH.D. (U. Tex.), *Chairman of Foreign Languages and Professor of German* (1963), 1947.
MICHEL J. BEAUCHEMIN, M.A. (Brown U.), *Assistant Professor of Romance Languages* (1966), 1956.
LASZLO BORSAY, PH.D. (U. Pittsburgh), *Assistant Professor of Classical Languages* (1965).
M. WILLIAM BUECHELE, M.A. (U. Colo.), *Instructor in German* (1964).
RAFAEL R. DEL VALLE, PH.D. (Natl. U. Mexico), *Associate Professor of Latin American Area Studies* (1963).
EMILE G. FRIERE, PH.D. (U. Pittsburgh), *Associate Professor of French* (1961), 1947.
PABLO GONZALEZ, M.A. (U. Pittsburgh), *Instructor in Spanish* (1966).
FRANCISCO HERRERA, M.A. (WVU), *Associate Professor of Spanish and Director of Latin American Area Program* (1964), 1946.
DONALD T. HUFFMAN, M.A. (Ind. U.), *Assistant Professor of German* (1965), 1956.
VICTOR J. LEMKE, PH.D. (U. Wisc.), *Professor of German* (1955), 1939.
ARTHUR C. McBRIDE, DOCTEUR DE L'UNIVERSITE BOBDEAUX (U. Bordeaux), *Professor of French* (1960), 1926.
WARREN F. MANNING, PH.D. (Harvard U.), *Professor of Romance Languages* (1952), 1928.
BOHDAN PLASKACZ, PH.D. (U. Ottawa), *Professor of Slavic Languages* (1963).
JOSEPH J. PRENTISS, M.A. (U. Pittsburgh), *Instructor in Classical Languages* (1966).
JOSEPH F. RENAHAN, M.S. (Yeshiva U.), *Instructor in Romance Languages* (1965).
ARMAND E. SINGER, PH.D. (Duke U.), *Professor of Romance Languages and Chairman of Humanities* (1963), 1940.

HARLEY U. TAYLOR, JR., PH.D. (Ind. U.), *Assistant Professor of German* (1963), 1949.
REBECCA E. WADE, M.A. (Middlebury C.), *Assistant Professor of French* (1955), 1945.

GEOLOGY AND GEOGRAPHY

DANA WELLS, PH.D. (Columbia U.), *Chairman and Professor of Geology* (1961), 1930.
ARTHUR E. BURFORD, PH.D. (U. Mich.), *Associate Professor of Geology* (1963), 1960.
ROBERT G. CORBETT, PH.D. (U. Mich.), *Associate Professor of Geology* (1967), 1962.
CHESTER L. DODSON, M.S. (WVU), *Assistant Professor of Geology* (1963).
ALAN C. DONALDSON, PH.D. (Penn St. U.), *Associate Professor of Geology* (1962), 1957.
HARRY M. FRIDLEY, PH.D. (Cornell U.), *Professor Emeritus of Geology* (1964), 1928.
WILLIAM H. GILLESPIE, M.S. (WVU), *Instructor in Geology* (1958), 1957.
MILTON T. HEALD, PH.D. (Harvard U.), *Professor of Geology* (1960), 1948.
RICHARD S. LITTLE, PH.D. (Syracuse U.), *Associate Professor of Geography* (1967), 1962.
JOHN C. LUDLUM, PH.D. (Cornell U.), *Professor of Geology* (1956), 1946.
RICHARD R. PILLSBURY, M.A. (LSU), *Assistant Professor of Geography* (1966).
PAUL H. PRICE, PH.D. (Cornell U.), *Professor of Geology* (1960).
JOHN J. RENTON, PH.D. (WVU), *Assistant Professor of Geology* (1965).

HISTORY

WILLIAM T. DOHERTY, JR., PH.D. (U. Mo.), *Chairman and Professor of History* (1963).
WESLEY M. BAGBY, PH.D. (Columbia U.), *Associate Professor of History* (1962), 1956.
WILLIAM D. BARNES, PH.D. (WVU), *Associate Professor of History* (1954), 1940.
JOHN A. CARUSO, PH.D. (WVU), *Professor of History* (1962), 1950.
OLIVER P. CHITWOOD, PH.D. (J. Hopkins U.), *Professor Emeritus of History* (1946), 1907.
ELIZABETH COMETTI, PH.D. (U. Va.), *Professor of History* (1964).
DONALD S. DETWILER, DR. PHIL. (Goettingen U.), *Assistant Professor of History* (1965).
JASON C. EASTON, PH.D. (U. Wisc.), *Professor Emeritus of History* (1963), 1938.
JOHN F. GOLAY, D.PHIL. (Oxford), *Professor of History* (1961).
JAMES W. HESS, PH.D. (Harvard U.), *Assistant Professor of History* (1964).
ELIZABETH K. HUDSON, PH.D. (Ind. U.), *Lecturer in History* (1964).
MORTIMER LEVINE, PH.D. (U. Penn.), *Associate Professor of History* (1961), 1955.
KURT ROSENBAUM, PH.D. (Syracuse U.), *Associate Professor of History* (1966), 1962.
IVAN C. SCOTT, PH.D. (U. Penn.), *Assistant Professor of History* (1965).
SARA R. SMITH, PH.D. (Columbia U.), *Associate Professor Emeritus of History* (1961), 1947.
EDWARD M. STEEL, JR., PH.D. (U. N.C.), *Associate Professor of History* (1961), 1956.
FESTUS P. SUMMERS, PH.D. (WVU), *Professor Emeritus of History and University Historian* (1965), 1932.

LIBRARY SCIENCE

ROBERT F. MUNN, PH.D. (U. Mich.), *Director of Libraries and Chairman and Professor of Library Science* (1957), 1952.
LORISE C. BOGER, M.S.L.S. (L.S.U.), *Senior Reference Librarian and Assistant Professor of Library Science* (1959), 1957.
ROBERT E. CONNELL, M.L.S. (Rutgers U.), *Senior Reference Librarian and Lecturer in Library Science* (1966).
STOKLEY B. GRIBBLE, M.S.L.S. (U. Ky.), *Assistant Director of Libraries and Assistant Professor of Library Science* (1964).
OLIVE D. LEWIS, B.S. (U. Minn.), *Assistant Professor of Library Science* (1962).
VICTORINE A. LOUSTALL, M.A.L.S. (WVU), *Assistant Professor of Library Science* (1966).

MATHEMATICS

ILAND D. PETERS, M.S. (WVU), *Acting Chairman and Associate Professor of Mathematics* (1957), 1941.
ANAND M. CHAK, PH.D. (Lucknow U.), *Assistant Professor of Mathematics* (1966).
CHARLES N. COCHRAN, M.S. (WVU), *Associate Professor of Mathematics* (1965), 1951.
ALLEN B. CUNNINGHAM, PH.D. (WVU), *Professor of Mathematics* (1960), 1946.
HANNIBAL A. DAVIS, PH.D. (Cornell U.), *Professor Emeritus of Mathematics* (1965), 1924.
JOY BROMBERG EASTON, M.S. (WVU), *Instructor in Mathematics* (1955), 1948.
HENRY W. GOULD, M.A. (U. Va.), *Associate Professor of Mathematics* (1965), 1958.
FRANZ X. HIERGEIST, PH.D. (U. Pittsburgh), *Assistant Professor of Mathematics* (1964).

ELMOR L. PETERSON, PH.D. (Carnegie Tech), *Assistant Professor of Mathematics* (1966).
JOSEPH K. STEWART, PH.D. (WVU), *Professor of Mathematics* (1952), 1930.
CHARLES H. VEHSE, PH.D. (Brown U.), *Professor Emeritus of Mathematics* (1965), 1929.
MARVIN L. VEST, PH.D. (U. Mich.), *Professor of Mathematics* (1955), 1931.
RONSON J. WARNE, PH.D. (U. Tenn.), *Professor of Mathematics* (1964).
STANLEY WEARDEN, PH.D. (Cornell U.), *Professor of Statistics* (1966).

PHILOSOPHY

JOSEPH F. LAMBERT, PH.D. (Mich. St. U.), *Chairman and Professor of Philosophy* (1963).
DONALD A. COLEMAN, PH.D. (Columbia U.), *Assistant Professor of Philosophy* (1965).
JOHN R. CRESSWELL, PH.D. (Cornell U.), *Professor of Philosophy* (1964), 1929.
THEODORE M. DRANGE, PH.D. (Cornell U.), *Assistant Professor of Philosophy* (1966).
ROBERT D. JEWELL, PH.D. (Brown U.), *Assistant Professor of Philosophy* (1964).
THOMAS W. SCHARLE, PH.D. (Notre Dame U.), *Assistant Professor of Philosophy* (1966),

PHYSICS

CHARLES D. THOMAS, PH.D. (U. Chicago), *Chairman and Professor of Physics* (1956), 1931.
ATAM P. ARYA, PH.D. (Penn St. U.), *Assistant Professor of Physics* (1964).
STANLEY FARR, M.S. (WVU), *Assistant Professor of Physics* (1966), 1950.
O. REX FORD, PH.D. (Cornell U.), *Professor Emeritus of Physics* (1963), 1925.
OLEG JEFIMENKO, PH.D. (U. Ore.), *Associate Professor of Physics* (1960), 1956.
ARNOLD D. LEVINE, PH.D. (Columbia U.), *Associate Professor of Physics* (1962), 1957.
ARTHUR S. PAVLOVIC, PH.D. (Penn St. U.), *Associate Professor of Physics* (1962), 1959.
EDWARD F. PULVER, PH.D. (Penn St. U.), *Assistant Professor of Physics* (1965).
HARVEY N. REXROAD, PH.D. (Duke U.), *Professor of Physics* (1962), 1947.
JOHN L. RODDA, II, PH.D. (Iowa St. U.), *Assistant Professor of Physics* (1965), 1963.
CARL A. ROTTNER, PH.D. (Case Tech), *Assistant Professor of Physics* (1966).
WILLIAM E. VEHSE, PH.D. (Carnegie Tech), *Assistant Professor of Physics* (1961).
DOUGLAS B. WILLIAMSON, ED.D. (Columbia U.), *Associate Professor of Physics* (1960), 1946.

POLITICAL SCIENCE

JOHN R. WILLIAMS, PH.D. (Duke U.), *Chairman and Professor of Political Science* (1961), 1949.
THOMAS M. DRAKE, M.A. (Duke U.), *Assistant Professor of Political Science* (1962).
CARL M. FRASURE, PH.D. (Ohio St. U.), *Professor of Political Science and Dean, College of Arts and Sciences* (1940), 1927.
ROYAL C. GILKEY, PH.D. (U. Minn.), *Associate Professor of Political Science* (1963), 1957.
JOHN A. JACOBSON, PH.D. (U. Md.), *Assistant Professor of Political Science* (1965).
DAVID S. MYERS, M.A. (Lehigh U.), *Instructor in Political Science* (1966).
GEORGE W. RICE, PH.D. (Ohio St. U.), *Assistant Professor of Political Science* (1960).
WILLIAM R. ROSS, M.A. (WVU), *Associate Professor of Political Science* (1963), 1939.
WILLIAM G. SIMPSON, M.A. (Western Reserve U.), *Instructor in Political Science* (1966).
IRVIN STEWART, PH.D. (Columbia U.), *Professor Emeritus of Political Science* (1967), 1946.
DAVID G. TEMPLE, PH.D. (U. Va.), *Assistant Professor of Political Science* (1966).

PSYCHOLOGY

QUIN F. CURTIS, PH.D. (U. Mich.), *Chairman and Professor of Psychology* (1949), 1941.
JAMES F. CARRUTH, PH.D. (U. Ill.), *Professor of Psychology* (1965), 1953.
PHILLIP E. COMER, PH.D. (WVU), *Assistant Professor of Psychology* (1966).
ORRIN H. CROSS, PH.D. (U. Pittsburgh), *Associate Professor of Psychology* (1957), 1951.
ROBERT L. DECKER, PH.D. (Carnegie Tech), *Associate Professor of Psychology* (1962), 1955.
IRVING J. GOODMAN, PH.D. (U. Rochester), *Assistant Professor of Psychology* (1966).
LARRY R. GOULET, PH.D. (St. Louis U.), *Assistant Professor of Psychology* (1965).
BARBARA B. GRISWOLD, PH.D. (U. Calif.), *Assistant Professor of Psychology* (1966).
ROBERT W. MILLER, PH.D. (Ohio St. U.), *Associate Professor of Psychology* (1965).
L. LYNN OURTH, PH.D. (U. Mo.), *Associate Professor of Psychology* (1966), 1962.

EUGENE A. QUARRICK, PH.D. (Syracuse U.), *Assistant Professor of Psychology* (1962).
ROBERT E. RANKIN, PH.D. (Ohio St. U.), *Professor of Psychology* (1965), 1954.
K. WARNER SCHAIE, PH.D. (U. Wash.), *Associate Professor of Psychology* (1964).
JAMES N. SHAFER, PH.D. (Ohio St. U.), *Professor of Psychology* (1966), 1953.
ARTHUR R. THOMAS, PH.D. (Northwestern U.), *Associate Professor of Psychology* (1962), 1956.

RELIGIOUS STUDIES

MANFRED O. MEITZEN, PH.D. (Harvard U.), *Associate Professor of Religious Studies* (1965).

SOCIOLOGY

HAROLD A. GIBBARD, PH.D. (U. Mich.), *Chairman and Professor of Sociology* (1948).
RONALD C. ALTHOUSE, PH.D. (Penn St. U.), *Assistant Professor of Sociology* (1966).
RICHARD A. BALL, PH.D. (Ohio St. U.), *Assistant Professor of Sociology* (1966).
HAROLD N. KERR, PH.D. (Ohio St. U.), *Associate Professor of Sociology* (1959), 1946.
EDWARD V. McMICHAEL, PH.D. (Ind. U.), *Assistant Professor (part-time) of Sociology* (1964).
JOHN D. PHOTIADIS, PH.D. (Cornell U.), *Professor of Sociology* (1966), 1965.
LEONARD M. SIZER, PH.D. (St. U. Iowa), *Associate Professor of Sociology* (1959).
I. THOMAS STONE, PH.D. (Cornell U.), *Assistant Professor of Sociology* (1966).
ERNEST A. VARGAS, M.A. (Columbia U.), *Assistant Professor of Sociology* (1966).
NEIL J. WELLER, PH.D. (U. Mich.), *Assistant Professor of Sociology* (1959).

SPEECH

LEONARD M. DAVIS, PH.D., (Northwestern U.), *Chairman and Professor of Speech* (1967), 1954.
BETTY SNYDER HALL, M.A. (WVU), *Instructor in Speech* (1961).
WALTER H. ROCKENSTEIN, PH.D. (Northwestern U.), *Associate Professor of Speech* (1967), 1965.
LLOYD W. WELDEN, SR., M.A. (U. Mo.), *Professor of Speech* (1961), 1947.

COLLEGE OF COMMERCE

THOMAS C. CAMPBELL, JR., PH.D. (U. Pittsburgh), *Dean of College of Commerce and Professor of Economics* (1964), 1948.
VANCE Q. ALVIS, PH.D. (U. Va.), *Professor of Economics* (1960), 1956.
JOHN H. CHAPMAN, JR., PH.D. (U. Colo.), *Assistant Professor of Economics* (1965).
LYNN E. DELLENBARGER, JR., PH.D. (U. Fla.), *Associate Professor of Finance* (1964).
BETTY G. FISHMAN, M.A. (N.Y.U.), *Lecturer in Economics* (1957), 1948.
LEO FISHMAN, PH.D. (N.Y.U.), *Professor of Economics and Finance* (1952), 1947.
RAYMOND M. HAAS, D.B.A. (Ind. U.), *Associate Professor of Marketing* (1965).
CARL W. HALE, PH.D. (U. Tex.), *Associate Professor of Economics* (1966).
PAUL W. HAMELMAN, PH.D. (U. Pittsburgh), *Associate Professor of Management* (1964), 1960.
THOMAS S. ISAACK, D.B.A. (Ind. U.), *Professor of Management* (1960), 1951.
EDWARD A. JOHNSON, M.I.M.R. (Cornell U.), *Assistant Professor of Management* (1966).
JAY E. JOHNSON, M.B.A. (N.Y.U.), C.P.A. (W. Va.), *Assistant Professor of Accounting* (1961), 1956.
GEORGE E. KIRK, M.B.A. (Ind. U.), *Assistant Professor of Management* (1964).
DENNIS R. LEYDEN, B.S. (Clemson U.), *Assistant Professor of Economics* (1962).
RAYMOND R. MCKAY, M.S. (S. Ill. U.), *Assistant Professor of Economics* (1966).
ROBERT S. MAUST, M.S. (WVU), C.P.A. (W. Va.), *Assistant Professor of Accounting* (1963).
WILLIAM H. MIERNYK, PH.D. (Harvard U.), *Professor of Economics* (1965).
JOSEPH NEWHOUSE, M.S. (WVU), *Assistant Professor of Economics and Finance* (1956), 1949.
RICHARD D. RAYMOND, PH.D. (Brown U.), *Assistant Professor of Economics* (1965).
EVAN O. ROBERTS, PH.D. (U. Wisc.), *Professor of Economics and Marketing* (1953), 1939.
ROBERT J. SAUNDERS, PH.D. (U. Ky.), *Assistant Professor of Economics* (1965).

CHARLES P. SKAGGS, M.S. (WVU), C.P.A. (W. Va.), *Assistant Professor of Accounting* (1964), 1954.

ANTHONY H. STOCKS, PH.D. (St. U. N.Y., Buffalo), *Associate Professor of Economics* (1965), 1961.

JAMES H. THOMPSON, PH.D. (U. Pittsburgh), *Professor of Economics* (1958), 1948.

VERN H. VINCENT, PH.D. (U. Mich.), C.P.A. (Tex., Tenn., W. Va.), *Professor of Accounting* (1957).

FRED E. WRIGHT, II, M.A. (WVU), *Associate Professor of Finance* (1963), 1951.

FRED A. ZELLER, PH.D. (Ohio St. U.), *Associate Professor of Economics* (1965).

CREATIVE ARTS CENTER

DIVISION OF MUSIC

RICHARD E. DUNCAN, PH.D. (Eastman Sch. of Music, U. Rochester), *Dean and Director of Creative Arts Center and Professor of Music* (1964), 1958.

CLIFFORD W. BROWN, M.F.A. (Carnegie Tech), *Assistant Dean of Creative Arts Center and Professor of Music* (1964), 1941.

THOMAS S. CANNING, M.M. (Eastman Sch. of Music, U. Rochester), *Associate Professor of Music. Composition, Theory* (1963).

ARNO P. DRUCKER, M.M. (Eastman Sch. of Music, U. Rochester), *Assistant Professor of Music and Chairman of Applied Music. Piano* (1962), 1959.

JON E. ENGBERG, M.M. (Eastman Sch. of Music, U. Rochester), *Assistant Professor of Music. Violoncello, Theory* (1963), 1959.

CLYDE N. ENGLISH, D.S.M. (Sch. of Sacred Music, Union Theol. Sem.), *Associate Professor of Music. Organ, Church Music* (1953), 1945.

REGINALD H. FINK, M.M. (U. Okla.), *Assistant Professor of Music. Brass Instruments, Theory* (1962).

HERMAN GODES, M.M. (Latvian St. Music Acad.), *Professor of Music. Piano* (1964), 1960.

JOSEPH A. GOLZ, M.A. (Columbia U.), *Associate Professor of Music and Director of Opera Department and Choral Organizations* (1962), 1959.

LEO HORACEK, PH.D. (U. Kans.), *Associate Professor of Music and Chairman of Music Education* (1964), 1960.

BARTON HUDSON, PH.D. (Ind. U.), *Assistant Professor of Music. Musicology* (1964).

GERALD LEFKOFF, PH.D. (Catholic U. of America), *Associate Professor of Music. Theory, Viola* (1961).

FRANK E. LORINCE, JR., PH.D. (Eastman Sch. of Music, U. Rochester), *Associate Professor of Music and Chairman of Theory and Composition* (1965), 1950.

JAMES E. MILTENBERGER, D.M.A. (Eastman Sch. of Music, U. Rochester), *Assistant Professor of Music. Piano* (1966), 1962.

DONALD C. PORTNOY, M.A. (Catholic U. of America), *Assistant Professor of Music Violin, Director of Symphony Orchestra and Summer Music Camp* (1962), 1959.

GEORGE E. SCHAFER, PH.D. (Eastman Sch. of Music, U. Rochester), *Professor of Music and Chairman of Graduate Studies. Lecturer in Music* (1962), 1954.

R. SCOTT STRINGHAM, PH.D. (Cornell U.), *Assistant Professor of Music. Music Education, Lecturer in Music* (1964).

DIVISION OF ART

JOHN D. CLARKSON, M.A. (U. Pittsburgh), *Chairman and Professor of Art* (1964), 1948.

HOWARD F. COLLINS, M.A. (Columbia U.), *Associate Professor of Art* (1965).

BARBARA ADELINE DRAINER, Ed.D. (Columbia U.), *Associate Professor of Art* (1964), 1952.

BEN F. FREEDMAN, M.A. (U. Ariz.), *Assistant Professor of Art* (1962), 1957.

GLENN B. HAMM, M.F.A. (Carnegie Tech), *Instructor in Art* (1965), 1964.

JOE F. MOSS, M.A. (WVU), *Assistant Professor of Art* (1964), 1960.

DIVISION OF DRAMA

SAM BOYD, JR., M.F.A. (Carnegie Tech), *Chairman and Professor of Drama* (1964), 1943.

ROBERT B. BURROWS, PH.D. (Ohio St. U.), *Professor of Drama* (1963), 1948.

JOE E. FORD, M.A. (WVU), *Associate Professor of Drama* (1962), 1953.

LENETTE M. HARDIN, M.A. (WVU), *Instructor in Drama* (1959).

A. JAMES HAWKINS, M.A. (Sacramento St. C.), *Instructor in Drama* (1965).
CHARLES D. NEEL, PH.D. (Cornell U.), *Assistant Professor of Drama* (1965), 1960.

COLLEGE OF ENGINEERING

AEROSPACE ENGINEERING

JEROME B. FANUCCI, PH.D. (Penn St. U.), *Chairman and Professor of Aerospace Engineering* (1964).

YU KAO HSU, PH.D. (R.P.I.), *Assistant Professor of Aerospace Engineering* (1966).

NATHAN NESS, PH.D. (Brooklyn Poly. Inst.), *Professor of Aerospace Engineering* (1964).

WILLIAM SQUIRE, M.A. (U. Buffalo), *Professor of Aerospace Engineering* (1961).

SYED YUSUFF, PH.D. (Brooklyn Poly. Inst.), *Professor of Aerospace Engineering* (1965).

AGRICULTURAL ENGINEERING

ALFRED D. LONGHOUSE, PH.D. (Cornell U.), *Chairman and Professor of Agricultural Engineering* (1945), 1938.

WALTER H. DICKERSON, JR., M.S.A.G.E. (V.P.I.), *Professor of Agricultural Engineering* (1957), 1953.

ROY E. EMERSON, M.S. (Cornell U.), *Associate Professor of Agricultural Engineering* (1957), 1940.

OSCAR R. HARMAN, M.S.A.G.E. (WVU), *Assistant Professor of Agricultural Engineering* (1965).

CHEMICAL ENGINEERING

HOWARD P. SIMONS, PH.D. (Ohio St. U.), *Chairman and Professor of Chemical Engineering* (1947).

RICHARD C. BAILIE, PH.D. (Iowa St. U.), *Associate Professor of Chemical Engineering* (1965).

GEORGE L. BLACKSHAW, PH.D. (N.C. St.), *Assistant Professor of Nuclear Engineering* (1965).

WILLIAM R. BOYLE, PH.D. (WVU), *Assistant Professor of Chemical Engineering* (1965).

HAROLD V. FAIRBANKS, M.S. (Mich. St. U.), *Professor of Metallurgical Engineering* (1955).

ALFRED F. GALLI, M.S.C.H.E. (WVU), *Associate Professor of Chemical Engineering* (1956).

DEAN O. HARPER, M.S. (Purdue U.), *Assistant Professor of Chemical Engineering* (1963).

PAUL R. JONES, M.Sc. (Ohio St. U.), *Professor of Ceramic Engineering* (1957).

JAMES A. KENT, PH.D. (WVU), *Professor of Nuclear Engineering* (1958).

WALTER A. KOEHLER, PH.D. (U. Wisc.), *Professor Emeritus of Chemical Engineering* (1963).

CHIN-YUNG WEN, PH.D. (WVU), *Professor of Chemical Engineering* (1959).

CIVIL ENGINEERING

JAMES H. SCHAUB, PH.D. (Purdue U.), *Chairman and Professor of Civil Engineering* (1960).

WILFRED H. BAKER, M.S.C.E. (Syracuse U.), *Professor of Civil Engineering* (1955), 1941.

JERRY C. BURCHINAL, M.S.C.E. (WVU), *Professor of Civil Engineering* (1962), 1946.

EVERETT C. CARTER, M.ENG. (U. Calif.), *Assistant Professor of Civil Engineering* (1963).

CHARLES R. JENKINS, PH.D. (Okla. St. U.), *Associate Professor of Sanitary Engineering* (1964), 1961.

EMORY L. KEMP, PH.D. (U. Ill.), *Professor of Civil Engineering* (1965), 1962.

BENJAMIN LINSKY, M.S.E. (U. Mich.), *Professor of Sanitary Engineering (Air Pollution)* (1963).

LARRY D. LUTTRELL, PH.D. (Cornell U.), *Assistant Professor of Civil Engineering* (1965).

WILLIAM A. SACK, PH.D. (Mich. St. U.), *Assistant Professor of Civil Engineering* (1966).

ROGER K. SEALS, M.S.E. (U. Fla.), *Assistant Professor of Civil Engineering* (1965).

EUGENE F. SMITH, PH.D. (U. Tex.), *Assistant Professor of Civil Engineering* (1966).

FREDERICK J. WEGMANN, M.S.C.E. (Clarkson C.), *Assistant Professor of Civil Engineering* (1966).

ELECTRICAL ENGINEERING

EDWIN C. JONES, M.S.E.E. (U. Ill.), *Chairman and Professor of Electrical Engineering* (1925).
EDWIN C. BARBE, M.S.E.E. (WVU), *Assistant Professor of Electrical Engineering* (1956).
PATRICK J. HAWKINS, PH.D. (Ohio St. U.), *Assistant Professor of Electrical Engineering* (1965).
ROBERT E. LEE, PH.D. (U. Rochester), *Assistant Professor of Electrical Engineering* (1966).
MARION J. SMITH, M.S.E.E. (U. Colo.), *Professor of Electrical Engineering* (1954).
NELSON S. SMITH, JR., D.Sc. (U. Pittsburgh), *Associate Professor of Electrical Engineering* (1956).
ROBERT E. SWARTWOUT, PH.D. (U. Ill.), *Professor of Electrical Engineering* (1962).

INDUSTRIAL ENGINEERING

RAYMOND E. SHAFER, M.S.I.E. (Ga. Tech.), *Chairman and Professor of Industrial Engineering* (1951), 1949.
SAMY E. G. ELIAS, PH.D. (Okla. St. U.), *Associate Professor of Industrial Engineering* (1965).
ROBERT D. FOWLER, M.S.I.E. (Ga. Tech.), *Professor of Industrial Engineering* (1963), 1959.

MECHANICAL ENGINEERING

HOWARD W. BUTLER, PH.D. (Yale U.), *Chairman and Professor of Mechanical Engineering* (1965).
WALTER S. CHMIELEWSKI, PH.D. (WVU), *Assistant Professor of Mechanical Engineering* (1967).
HASIN T. GENCSEY, M.S.M.E. (WVU), *Associate Professor of Mechanical Engineering* (1957).
HENNING MULLER, DR.-ING. (U. Mainz), *Visiting Professor of Mechanical Engineering* (1966).
IN-MEEI NEOU, PH.D. (Stanford U.), *Professor of Mechanical Engineering* (1966).
JEROME F. PARMER, PH.D. (Okla. St. U.), *Associate Professor of Mechanical Engineering* (1964), 1957.
SHIGEO SHIN, DR. OF ENG. (Osaka U.), *Visiting Assistant Professor of Mechanical Engineering* (1966).
ROBERT D. SLONNEGER, M.S.M.E. (U. Tex.), *Professor of Mechanical Engineering* (1963), 1955.
EMIL J. STEINHARDT, PH.D., (U. Pittsburgh), *Assistant Professor of Mechanical Engineering* (1966).

THEORETICAL AND APPLIED MECHANICS

EDWARD F. BYARS, PH.D. (U. Ill.), *Chairman and Professor of Theoretical and Applied Mechanics* (1960).
WARREN G. LAMBERT, PH.D. (Iowa St. U.), *Associate Professor of Theoretical and Applied Mechanics* (1964).
MARK LEVINSON, PH.D. (Calif. Inst. Tech.), *Associate Professor of Theoretical and Applied Mechanics* (1966).
JAMES H. McELHANEY, PH.D. (WVU), *Associate Professor of Theoretical and Applied Mechanics* (1966), 1965.
HELEN L. PLANTS, M.S.C.E. (WVU), *Assistant Professor of Theoretical and Applied Mechanics* (1956), 1947.
ROBERT D. SNYDER, PH.D. (WVU), *Associate Professor of Theoretical and Applied Mechanics* (1965), 1961.
GEORGE W. WEAVER, M.S.M.E. (WVU), *Professor of Theoretical and Applied Mechanics* (1962), 1948.
DONALD T. WORRELL, M.S.E.E. (WVU), *Professor of Theoretical and Applied Mechanics* (1955), 1941.

SCHOOL OF MINES

CHARLES T. HOLLAND, M.S.E.M. (WVU), *Dean of the School of Mines and Professor of Mining Engineering* (1961), 1930.

ABDEL-KADER KOTB, PH.D. (Okla. U.), *Assistant Professor of Petroleum Engineering* (1966).
RICHARD W. LAIRD, M.S.E.M. PET.E. (WVU), *Associate Professor of Petroleum Engineering* (1953), 1947.
JOSEPH D. MCCLEUNG, M.S.E.M. (U. Pittsburgh), *Associate Professor of Mining Engineering* (1961), 1941.
JAMES A. WASSON, M.S.PET.E. (Penn St. U.), *Assistant Professor of Petroleum Engineering* (1960).

COLLEGE OF HUMAN RESOURCES AND EDUCATION

DIVISION OF CLINICAL STUDIES

OSCAR G. MINK, ED.D. (Cornell U.), *Director and Associate Professor of Clinical Studies* (1966).
CONSTANTINOS E. ALEXAKOS, PH.D. (U. Wisc.), *Assistant Professor of Counseling and Guidance and Research Associate* (1966).
THOMAS L. BLASKOVICS, PH.D. (U. Wisc.), *Assistant Professor of Rehabilitation Counseling* (1965).
ARRETA L. JARANKO, ED.D. (WVU), *Assistant Professor of Reading* (1966), 1962.
EDDIE C. KENNEDY, ED.D. (Ind. U.), *Professor of Reading* (1962), 1953.
ROBERT L. MASSON, ED.D. (U. Buffalo), *Associate Professor and Chairman* (1963).
GLEN P. MCCORMICK, PH.D. (Purdue U.), *Assistant Professor of Speech Pathology and Audiology* (1966).
JAMES M. MULLENDORE, PH.D. (Northwestern U.), *Professor of Speech Pathology and Audiology* (1963).
GABRIEL A. NARDI, PH.D. (U. Wisc.), *Assistant Professor of Special Education* (1966).
ROBERT H. NEFF, ED.D. (WVU), *Assistant Professor of Special Education* (1961), 1955.
CHARLES E. SMITH, PH.D. (U. Wyo.), *Assistant Professor of Counseling and Guidance* (1966).
GEORGE E. STORMER, ED.D. (U. Ill.), *Assistant Professor of Counseling and Guidance* (1966).
WILLIAM V. WAGNER, ED.D. (WVU), *Associate Professor of Counseling and Guidance* (1963), 1959.
H. WALDO WASSON, PH.D. (L.S.U.), *Professor of Speech Pathology and Audiology* (1962).

DIVISION OF EDUCATION

WILLIAM K. KATZ, ED.D. (U. Tex.), *Director of Division of Education and Associate Professor of Education* (1966), 1959.
BENJAMIN H. BAILEY, ED.D. (U. Fla.), *Associate Professor of Education* (1962), 1959.
LADDIE R. BELL, ED.D. (U. Va.), *Associate Professor of Education* (1962).
EARL R. BOGGS, PH.D. (Geo. Peabody C.), *Professor of Education* (1960).
THOMAS J. BRENNAN, ED.D. (Bradley U.), *Professor of Education* (1959), 1935.
SARA ANN BROWN, PH.D. (Iowa St. C.), *Professor of Education and Professor of Home Economics Education* (1955), 1946.
RUSSELL C. BUTLER, PH.D. (Cornell U.), *Professor of Education and Professor of Agricultural Education* (1959), 1944.
WINGIE ANN CARRUTH, PH.D. (N.Y.U.), *Professor of Education and Professor of Physical Education* (1960), 1953.
KERMIT A. COOK, PH.D. (U. Minn.), *Professor of Education* (1959), 1935.
GLENNIS H. CUNNINGHAM, M.A. (WVU), *Instructor in Education* (1956).
RICHARD C. FRANKLIN, ED.D. (Columbia U.), *Professor of Education and Professor of Sociology* (1966).
WILSON I. GAUTIER, ED.D. (WVU), *Assistant Professor of Education* (1965), 1963.
KEITH E. GLANCY, PH.D. (Purdue U.), *Associate Professor of Education* (1965).
HARRY B. HEFLIN, PH.D. (U. Pittsburgh), *Professor of Education* (1964).
ARTHUR N. HOFSTETTER, ED.D. (U. Va.), *Chairman of Educational Administration and Professor of Education* (1960), 1955.
FREDERICK J. HOLTER, PH.D. (N.Y.U.), *Professor of Education and Professor of Physical Education* (1963).
LEO HORACEK, PH.D. (U. Kans.), *Associate Professor of Education and Associate Professor of Music* (1964), 1960.
STANLEY O. IKENBERRY, PH.D. (Mich. St. U.), *Dean of College of Human Resources and Education and Associate Professor of Education* (1965), 1962.

ELMIRA L. JOHNSON, PH.D., (U. Wisc.), *Assistant Professor of Education* (1965).
 WILLIAM R. JOHNSTON, ED.D. (U. Toledo), *Assistant Professor of Education* (1966).
 WARREN G. KELLY, M.S. (WVU), *Assistant Professor of Education and Assistant Professor of Agricultural Education* (1957).
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 JOHN J. PATERSON, PH.D. (Mich. St. U.), *Associate Professor of Education and Research Coordinator* (1965).
 JOHN SEMON, M.S. (WVU), *Associate Professor of Education and Associate Professor of Physical Education* (1960), 1959.
 MENG-SHU TSENG, ED.D. (Ind. U.), *Assistant Professor of Education* (1966).
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 SARA ANN BROWN, PH.D. (Iowa St. U.), *Professor of Home Economics Education and Professor of Education* (1955), 1946.
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HUGH A. LINDSAY, PH.D. (U. Toronto), *Associate Professor* (1960), 1955.
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HERBERT E. WARDEN, PH.D. (U. Minn.), M.D. (U. Chicago), *Professor* (1962), 1960.

SCHOOL OF PHARMACY

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ALFRED C. CORE, PH.D. (U. Ill.), *Associate Professor of Pharmaceutical Chemistry* (1966), 1960.
JAMES KHAL-JIN LIM, PH.D. (U. N.C.), *Assistant Professor of Pharmaceutics* (1966).
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MICHAEL MUSULIN, PH.D. (U. Pittsburgh), *Associate Professor of Pharmacy Administration* (1965).
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ALBERT F. WOJCIK, PH.D. (U. Pittsburgh), *Associate Professor of Pharmacy Administration* (1963), 1945.
PAUL ZANOWIAK, PH.D. (U. Fla.), *Assistant Professor of Pharmaceutics* (1964).

SCHOOL OF PHYSICAL EDUCATION

RAY O. DUNCAN, Ed.D. (U. Ill.), *Dean of School of Physical Education and Professor of Physical Education* (1952).

WINCIE ANN CARRUTH, Ph.D. (N.Y.U.), *Chairman of Women's Physical Education and Professor of Physical Education* (1957).

JOHN W. HESEN, M.D. (Med. C. of Va.), *Associate Professor of Physical Education* (1966), 1957.

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JOSEPH M. HUTCHISON, JR., M.S. (WVU), *Assistant Professor of Recreation* (1961), 1954.

BETHOLENE F. LOVE, M.S. (U. Okla.), *Associate Professor of Health Education* (1965), 1955.

JOHN G. SCHERLACHER, M.Ed. (U. Pittsburgh), *Chairman and Professor of Recreation* (1960), 1947.

JOHN SEMON, M.S. (WVU), *Chairman of Department of Physical Education for Men and Associate Professor of Physical Education* (1955), 1943.

THOMAS J. SHEEHAN, Ph.D. (Ohio St. U.), *Associate Professor of Physical Education* (1965).

PATRICK A. TORK, M.S. (WVU), *Professor of Physical Education* (1953), 1943.

C. PETER YOST, Ph.D. (U. Pittsburgh), *Chairman of Safety Education and Professor of Physical Education* (1958), 1946.

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